V.—NOTES ON CORALS OF THE GENUS ACROPORA (MADREPORA LAM.) WITH NEW DESCRIPTIONS AND FIGURES OF TYPES, AND OF SEVERAL NEW SPECIES.

BY A. E. VERRILL.

MANY changes in the nomenclature of this great and difficult genus have recently been made, especially in the extensive descriptive catalogue by Brook. But in consequence of the new determinations of many of the species by him, and of his redescriptions of a number of the types of Ehrenberg, Edw. and Haime, Quelch, and others, it has become very desirable to compare the types of Dana and other American writers with his new descriptions.

It is certain that there is still great confusion among writers on corals as to the character and limits of many of the species of this genus, and especially as to the application of the names given by Lamarck, Ehrenberg, and other early writers to some of the species. Such Lamarckian names as *laxa*, *abrotanoides*, *corymbosa*, and others have each been applied to a dozen or more species, by as many different writers.

This is due partly to the total lack of figures of many of the older types, and partly to the very short and imperfect descriptions. Brook has done great service by redescribing in detail many of these original types, in the museums of Berlin, Paris, and the British Museum. But if he could have figured them, his work would have been of much greater value.

Now that photographs of corals can be so easily and cheaply reproduced, it is to be hoped that all the extant types will soon be illustrated.

At this time, owing to the lack of funds for the purpose, I am able to give figures of only a few of the types in our museum, but I hope that more work of this kind can be done at no distant time.

In this article I have undertaken to redescribe only a few selected out of the whole number of Dana's types that are in the Yale Museum,* selecting those in respect to which European writers have made the most mistakes, and those which Dana did not figure. I have also given additional descriptions of several of my own types, described in 1864–68, and on the type of *A. tubigera* (Horn, 1860) I have added descriptions of several new species.

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* The principal set of Dana's types is in the U. S. Nat. Museum. Those have been enumerated by Mr. R. Rathbun, Proc. U. S. Nat. Mus., x, 1887. But he did not redescribe them.

A number of these types are here figured from enlarged photographs, made by Mr. A. Hyatt Verrill.

Acropora Oken (restr.). Type, *A. muricata.*

Madrepora (*pars*) Lam., Syst. Anim., p. 371, 1801 (*non* Linné, ed. x). Lam, Hist. Anim. s. Vert., ii, p. 277, 1816. Dana, Zoöph., p. 435, 1846. Edw. and Haime, Hist. Corall., iii, p. 132, 1860 (*non* Ehr.).

Acropora (*pars*) Oken, Lehr. Naturg., p. 66, 1815 (type, 3d species=*A. muricata*).

Madrepora Brook (with ten subgenera), Cat. Mad. Brit. Mus., i, p. 22, 1893.

Isopora Vaughan, Fossil Corals Curacoa, etc., p. 68, 1901. Stony Corals Porto Rican Waters, Bull. U. S. Fish Comm. for 1900, ii, p. 312, 1901.*

On pages 110–113 and 164, I have given reasons for displacing *Madrepora* as the name of this genus, and for the substitution of *Acropora* Oken.

In brief they are these:

1st. No recognized species of this genus was included in *Madrepora* by Linné, in his Syst. Nat., ed. x.

2d. *M. muricata* (auth.), which originally included all the known species of *Acropora*, was put under *Millepora* in the ed. x, though placed in *Madrepora* in ed. xii, as also by Pallas. Therefore it cannot properly be taken as the type of *Madrepora* if the ed. x is to be used as the starting point of the binomial system.

3d. Lamarck, in 1801, gave only two species as examples of *Madrepora*, viz: *M. muricata* and *M. porites.* The latter was made the type of the genus *Porites* by Link, in 1807, otherwise it might have been adopted for the type of *Madrepora.*

4th. Oken, in 1815, proposed the genus *Acropora*, including three species, of which the third was *A. muricata.* This can be adopted as its true type, because the second had already been placed in *Porites* by Link, 1807; and the first was placed in *Pocillopora* by Lamarck, in 1816. This leaves the name *Acropora* clearly available for the great genus of which *A. muricata* is the type.

The genus *Acropora* (restr.) is characterized by the presence of at least two forms of corallites. In all branched forms there is a symmetrical and usually larger axial corallite at the end of each branch (sometimes more than one), which produces radial or lateral buds around its base. These buds mostly develop into a symmetrical, often one-sided or labiate radial corallites in which the zoöids may have longer directive tentacles and wider directive septa.

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* Mr. Vaughan has recently authorized me to state that he now accepts the name *Acropora* for this genus, instead of *Isopora.* See p. 206.

More or less of the radial corallites become larger and symmetrical and eventually may become the axial corallites of new branches or branchlets.

Other radial corallites, without prominent lips, often occur on the larger branches, or on their under sides, wholly immersed in the cœnenchyma.

Most, if not all, of the species when young form incrusting groups or plates. In this stage new corallites are formed around the margins from exothecal buds. Massive or unbranched species sometimes have scattered axial corallites, scarcely more prominent than the others.

The porous cœnenchyma is usually scanty in the smaller branches, but often becomes abundant in the basal mass and larger branches.

The septa are usually 12, in two cycles, those of the second cycle being narrow and thin, and often rudimentary or entirely lacking. The directive septa are usually wider than the others, and often unequal. Sometimes all the septa are nearly abortive.

In several species a few larger or giant calicles occur, with 24 septa.

The surface of the cœnenchyma varies much in character and often furnishes useful specific characters, but it is liable to vary on different parts of a single specimen, according to age and other conditions. It is commonly porous or pitted, and more or less thickly covered with minute rough or sharp spinules or granules.

The walls of the corallites may be regularly costulate, or else covered with granules, either in rows or densely grouped. These differences afford useful specific characters, but are liable to vary.

Brook (Cat. Mad., 1893) recognized 220 species. Probably many of these will be united when larger series can be compared. Probably Brook has attached too much importance to variations in modes of growth.

I have studied about 120 species, most of which seem valid, including those described by Dana, a number of the types of Edw. and Haime, and many others from China, the East Indies, Ceylon, Red Sea, etc. But of many of these I have not seen good series.

The types of most of Dana's species collected by the U. S. Expl. Exped. are in the U. S. National Museum. The first series of the duplicates of that collection was early given to Professor Dana for the Museum of Yale University. These I found in the original packages, with Dana's labels, when I took charge of them in 1864.

A second series of duplicates was selected from the collections in the National Museum (then in the Smithsonian Inst.) by me in 1860, under the direction of Professor S. F. Baird, for the Museum of Comparative Zoölogy.

The types of Dana's species received from other sources are mostly in the Museum of Yale University. The most important of these came from Point Pedro, Ceylon, collected in 1843, by the Rev. George H. Apthorp, who was a missionary there, 1833–1844. His letters relating to this valuable collection are still preserved in the museum.* Some of the specimens recorded by Dana as from "Singapore" probably were from this collection, but others were correctly recorded as from Ceylon :—e. g. *M. effusa*, *M. plantaginea*, *M. efflorescens.* The locality-labels of some of the Ceylon specimens were lost before Dana studied them.

The types of my own species, from the U. S. North Pacific Expl. Exped., are in the Nat. Mus., but duplicates or fragments of most of them are also in the Museum of Yale University. Other species described by me in 1864–1866 are in the Museum of Comparative Zoölogy and Yale Museum. The species studied by me from the Red Sea were mostly in the Ward collection, afterwards purchased by the Field Columbian Museum of Chicago, but duplicates or fragments of many of them are also in the Yale Museum.

All the West Indian forms seem to be mere growth-varieties of one polymorphic species. See *A. muricata* and varieties, pp. 165–168.

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* The Rev. George H. Apthorp, of the American Ceylon Mission, was born May 31st, 1798, at Quincy, Mass.; died at Oodoopitty, Ceylon, June 8th, 1844. He graduated at Yale College in 1829, and at Princeton Theol. Seminary in 1832. Sailed for Ceylon July 1833, arriving there in Oct. 1833.

He was a very devout man and a devoted missionary, laboring, apparently, in a very barren and unpromising field, under many and great disadvantages.

The collection of corals was made at Point Pedro, about 7 miles from Varany, where he was then stationed with his wife, who aided in obtaining and bleaching the corals, and also in making a collection of shells sent with them.

In his letters of 1843, to Prof. Benj. Silliman, Sr., he mentions some of the difficulties encountered, both in obtaining and also in packing the corals, for no suitable packing materials could be had, except the cast-off garments of the girls in the mission school. His specimens arrived in good condition, however.

He also states that no other corals had ever been sent away from that locality. Some of the species sent by him are still very rare in collections, as for example, *Pocillopora grandis* D.

Notes on the Distribution and Subdivisions of Acropora.

The following list contains most of the species that I have personally studied, with their principal recorded localities. It is probable that most of the East Indian species have a very wide distribution, though at present recorded from only a few localities, or perhaps from only one. Many species are known to range from Singapore to Tahiti or the Fiji Is., or even to the Great Barrier Reef, and to the Red Sea. Probably many others will be found to have as great a range, when more fully collected.

This wide distribution, and even a greater one, is well known to occur, also, in the case of numerous mollusks, echinoderms, etc., characteristic of the Indo-Pacific fauna.

But it is probable that local variations, especially in growth-forms, will occur in the same coral when found in widely separated localities, as is the case in other groups. Probably many of these growth-variations have been described as distinct species, but without a large series of specimens it is not possible to determine this, in most cases. The variations of *A. muricata* in the West Indies should serve as a caution against overestimating the importance of mere forms of growth in corals of this genus and others.

Many mollusks and echinoderms of the East Indian fauna range to Australia, Africa, and even to the Hawaiian Islands. But I have never seen an authentic specimen of *Acropora* from the Hawaiian Islands. Local collectors assert that the genus does not occur there. But great quantities of corals, etc., are brought from the Polynesian Islands to Honolulu by the missionary vessels and sold there as curiosities.

Many corals, seen in collections, labelled as from the Hawaiian Islands, have been obtained in this way, but are natives of the Caroline Islands, Ebon Island, the Kingsmills Islands, etc. This is especially the case with ornamental species, like *Stylaster elegans* V., *Distichopora nitida*, etc.

Probably this was the case with the several species of *Acropora*, recorded from the Hawaiian Islands by Brook. Their occurrence there certainly needs confirmation, for in the large authentic collections of corals that I have studied from those islands no *Acropora* has occurred.

Specimens of corals are brought to Singapore from long distances by the natives, for sale, and thus may be recorded from there erroneously.

Similarly, species of this genus have been recorded from St. Helena, the White Sea, etc., where they probably do not live.

Though some of the ten "subgenera" of Brook are useful divisions, for diagnostic purposes, others are not of any practical value, and often serve more to mislead than to help the student. This remark applies particularly to those based on slight differences in the mode of growth or branching, and on small variations in the size or prominence of the terminal or axial corallites. One part of a single specimen will often go in one such "subgenus," while another part will go in another.

The forms of the radial corallites; the texture of the cœnenchyma; and the presence or absence of distinct costæ, would give more constant characters for the differentiation of sections of the genus.

For this reason much enlarged photographic figures of the calicles and cœnenchyma are of the greatest value in illustrating species of this genus. Drawings seldom give the complex texture satisfactorily. Young specimens of all the profusely branched species appear totally unlike the mature forms, and are, therefore, apt to be erroneously determined.

List of Species of Acropora examined.

I have arranged the species alphabetically, for greater convenience of reference.

An asterisk prefixed, indicates that the species is in the Museum of Yale University.

Authorities for names and localities are often much abbreviated: B.=Brook; D.=Dana; E. and H.=Edw. and Haime; Kl.=Klunzinger; Q.=Quelch; R.=Rehberg; St.=Studer; V.=Verrill.

**Acropora abrotanoides* (Lam., *non* Dana, see *polymorpha*). Brook, op. cit., p. 56, 1893.

Singapore (B.); Polynesia; Tahiti (B.); Great Barrier Reef (B.).

*A. *acervata* (Dana). Brook, p. 147. See notes, below.
Singapore (D., V.).

**A. aculeus* (Dana). Brook, p. 104.
Fiji (D.); Philippines? (Quelch).

**A. acuminata* (Ver.) Brook, p. 38. See notes, below.
Kingsmills Is. (Ver.).

**A. alliomorpha* (Brook, p. 87). Singapore (B.).

**A. amblyclados* (Brook, p. 140).
Singapore, Indian O., and Australia (B.).

**A. appressa* (Ehr., D., not *appersa*, as in Edw. and H.) Brook, p. 85. See notes, below.

Singapore and Ceylon (D., V.). Loc. of type unknown.

**A. Arabica* (E. and H.) Brook, p. 66.
Red Sea (E. and H.); Seychelles (B.).

**A. arbuscula* (D.) Brook, p. 40. See notes, below.
Singapore (D., V., B.); East Indies; Sulu Sea (B.); Great Barrier Reef (B.).

**A. arcuata* (Brook, p. 102, pl. xii).
Samoa (Br.) ; Fiji ? (V.).

**A. armata* (Brook, p. 100; *non M. spicifera*, Var., D., pl. 33, figs. 4, 4*a*, young). Brook, p. 100. See *A. cytherella* and *A. turbinata* in notes, below.
Singapore; Tahiti (B.); Fiji ?; Diego Garcia (B.). Perhaps not distinct from *turbinata*.

A. aspera (D.) Brook, p. 62.
Fiji (D.); Philippines (Q.); Great Barrier Reef (B.); New Hanover (B.).

**A. assimilis* (Brook, p. 85, pl. xx, fig. A.=*M. appressa* D., *non* Ehr., t. Brook). See notes, below.
Singapore (D., V.); Ceylon (V.); Amboina (Q.).

**A. austera* (D.) Brook, p. 56. See notes, below.
Singapore (B.); Philippines ? (Q).

**A. brachiata* (D.) Brook, p. 43.
E. Indies ; Sulu Sea (D.); Fiji, Sumatra, etc. (B.).

A. calamaria (Brook, p. 154, pl. xxiii, A, B.).
Rodriguez (B., type).

A. Brueggemanni (Brook, p. 145, pl. xxiv, xxxv)=*M. laxa* Brug., *non* Lam.
Singapore (type, B., V.); Torres St. and G. Barrier Reef (B.).

**A. canaliculata* (Klz.) Brook, p. 151.
Red Sea (Kl.); G. Barrier Reef (B.).

**A. carduus* (D.) Brook, p. 178.
Fiji (Q.); New Britain (B.); Mauritius (B.); ? Australia (B.).

**A. cerealis* (D.) Brook, p. 91.
Sooloo Sea (D.); Singapore (B.); Amboina (B.); Ternate (B.); Samoa, Fiji, and Tongatabu (B.); Great Barrier Reef (B.); Mauritius and Seychelles (B.).

A. clathrata (Brook, p. 49, pl. v, vi).
Mauritius (B.).

A. concinna (Brook, p. 165, pl. xvii).
Mauritius, type, and Amirante Is. (B.).

A. conferta (Q.) Brook, p. 108.
Fiji (Q.); Tongatabu, Torres St., Amirante Is., and Great Barrier Reef (B.).

**A. confraga* (Q.) Brook, p. 182.
Fiji (Q.); Malacca (B.); Pelew I. (V.).

**A. conigera* (D.) Brook, p. 34.
Singapore (D., V.).

**A. convexa* (D.) Brook, p. 118.
Singapore (D., V.); Cebu I. and Ceylon (V.); Tongatabu and G. Barrier Reef (B.).

**A. corymbosa* (Lam., *non* Dana) Brook, p. 97. See *surculosa.*
Indian O.; Red Sea (Kl., B.); Rodriguez (B.); Zanzibar ? (V.); China (B.); Tahiti (B.); Great Barrier Reef (B.); Fiji (B.); Ramesvarum (B.); Tizard Bank (B.).

A. cribripora (D.) Brook, p. 123.
Fiji (D.); Tongatabu and Gr. Barrier Reef (B.).

**Acropora cucullata* Ver., sp. nov. See notes, below.
Indo-Pacific (V.).

A. cuneata (D.) Brook, p. 134.
Fiji (D., Q., B.); Great Barrier Reef (B.).

**A. cuspidata* (D.) Brook, p. 124.
Tahiti (D.); Ponapé (B.).

**A. cyclopea* (D.; not *cycloptera*, as in E. and H.) Brook, *pars*, p. 33.
Wakes I., Pacific O. (D., V.). Not West Indian, as in Brook.

**A cytherea* (D.) Brook, p. 99.
Tahiti (D., V.); Singapore (D., B.); Solomon Is. (B.); Ceylon (B.); Mauritius (B.); Red Sea (Kl., B.); Diego Garcia (B.).

**Acropora cytherella* Ver., sp. nov. (=*M. spicifera* D., var.). See notes, below.
Tahiti (D.).

**A. Danæ* (E. and H., Ver., =*M. deformis* D., *non* Mich.) Brook, p. 57.
Tahiti (D.).

**A diffusa* (Ver.) Brook, p. 80. See notes, below.
Kingsmills Is. (V.); Banda (Q., B.); E. Indies (B.).

**A. digitifera* (D.) Brook, p. 75. See notes, below.
E. Indies (D., V.); Madagascar (B.); Gr. Barrier Reef (B.).

**A. dissimilis* Ver. sp. nov. (=*M. echidnæa* D., *non* Ehr.). See notes below.
E. Indies and Sulu Sea (D.).

**A. divaricata* (D.) Brook, p. 64.
Fiji (D.); Seychelles (B.); Gr. Barrier Reef (B.); Amirante Is. (B.).

**A. echinata* (D.) Brook, p. 184.
Fiji (D.); Sulu Sea (B.); Liu Kiu Is. (B.); Samoa (B.); Australia (B.); ? Hawaii (B.), probably imported.

**A. efflorescens* (D.) Brook, p. 35.

Ceylon (D., V., type in Yale Mus.); Fiji (D.); Singapore (B.).

**A. effusa* (D.) Brook, p. 76 (*non* Quelch, t. Brook). See notes, below.

Ceylon (D., V., type in Yale Mus.); Great Barrier Reef (B.).

**A. Ehrenbergii* (E. and H.=*scandens* (Kl., t. Brook) Brook, p. 48. See notes, below.

Red Sea (E. and H., B., V.); Persian Gulf (B.); Indian O. (B.).

**A. erythræa* (Klz.) Brook, p. 157.

Red Sea (Kl.); Mauritius and Maldive Is. (B.); Great Barrier Reef (B.).

A. exigua (D.) Brook, p. 125.

Fiji (D.); New Hebrides and Solomon Is. (B.).

A. exilis (Brook, p. 172, pl. x, C, D).

G. Barrier Reef (B., type); China Sea and Arafura Sea (B.).

**A. florida* (D.) Brook, p. 53.

Fiji (D.); Tongatabu, Malacca, and Louisade Is. (B.).

**A. formosa* (D.) Brook, p. 43.

Fiji (D.); E. Indies (V.); Sumatra, Torres St., Sulu Sea, New Ireland (B.).

**A. Forskalii* (Ehr., Klz.) Brook, p. 70.

Red Sea (Ehr., K., V.); Persian Gulf (B.).

**Acropora fraterna* Ver., sp. nov. (=*M. plantaginea*, *pars*, Br.). See notes, below.

Tahiti (D.).

**A. gemmifera* (Brook, p. 142, pl. xxi), near *A. fruticosa* Br.

Fiji, Torres St., Arafura Sea, and G. Barrier Reef, type, (B.).

**A. globiceps* (D.) Brook, p. 152.

Tahiti (D.).

**A. gracilis* (D.) Brook, p. 32.

Sulu Sea (D.); Fiji, Amboina, and Ceylon (B.).

A. grandis (Brook, p. 42, pl. i, f. A, B).

G. Barrier Reef (B.).

**A. gravida* (D.) Brook, p. 59.

Singapore (D., V.); Fiji and G. Barrier Reef (B.).

A. Haimei (E. and H.) Brook, p. 77 (*non arbuscula* Ver.).

Red Sea (E. and H., B., V.); Ceylon, Mauritius, Maldives, Singapore, and Fiji (B.).

**A. hebes* (D.) Brook, p. 128.

Fiji (D., V., B.); Malacca, Torres St., and G. Barrier Reef (B.).

A. Hemprichii (Ehr., Kl.) Brook, p. 173.

Red Sea (Ehr., K., V., B); Ceylon, Solomon Is., and G. Barrier Reef (B.).

**A. horrida* (D.) Brook, p. 188.

Fiji (D., V.); ? Arafura Sea (B.).

A. humilis (D.) Brook, p. 145.

Fiji (D., B.); G. Barrier Reef (B.).

**A. hyacinthus* (D.) Brook, p. 107.

Fiji (D., V., B.); Tizard Bank and G. Barrier Reef (B.).

A. hydra (Brook, p. 181,=*M. longicyathus* Ort., *non* E. and H., t. Brook).

Singapore (V.).

**A. implicata* (D.) Brook, p. 172.

Fiji (D.).

**A. indurata* Ver., sp. nov. See notes, below.

Australia (V.).

A. (*Isopora*) *labrosa* (D., Stud.). See *A. palifera.*

Sulu Sea (D.).

**A. laxa* (Lam., *non* Ehr.) Brook, p. 46, from type.

Seychelles, Rodriguez, Macclesfield Bank, and G. Barrier Reef (B.).

**A. longicyathus* (E. and H., *non* Ort.; *non prolixa* V.) Brook, p. 187, from type.

New Guinea (B.); Palau I. (V.).

**A. Luzonica* Ver., sp. nov. See notes, below.

Luzon, near Manilla (V.), type in Yale Mus.

**A. microphthalma* (Ver.) Brook, *pars*, p. 168. See *A. parvistella* V., and notes, below.

Loo Choo Is. (V.), type in Yale Mus.

**A. millepora* (Ehr., D., *non* D., t. Brook). Brook, p. 116. See notes below.

Singapore (D., V., B.); Ceylon (D., V., B.); Gr. Barrier Reef (B.).

**A. muricata* (L.), Oken. Brook, pp. 23–30. See pp. 166–169.

*Var. *cervicornis* (Lam.).

*Var. *prolifera* (Lam.).

*Var. *flabello-prolifera* (Ver., p. 167).

*Var. *palmato-prolifera* (Ver., p. 167).

*Var. *surculo-palmata* (Ver., p. 167).

*Var. *cornuta* (D. and M.).

*Var. *flabellum* (Lam.).

*Var. *palmata* (Lam.).

*Var. *perampla* (Horn) V., p. 168,=*M. alces* auth., ? *non* Dana.

*Var. *infundibulum* (Ver., p. 168).

Var. *columnaris* (Ver., p. 168).

*Var. *clivosa* (V.=*cyclopea* Br., *non* Dana).

Florida and the West Indies, to Colon and Cumana.

**A. nasuta* (D.) Brook, p. 73. See notes, below.
Tahiti (D., V., B.); Fiji (B.).

**Acropora neglecta* Ver., sp. nov. See notes, below.
Fiji (Dana).

**A. nobilis* (D.) Brook, p. 135. See notes, below.
Singapore (D., V.); Ceylon (V.); Java (B.).

*Var. *secunda* (D., Ver. from type). ? Brook (*pars*) p. 30.
Singapore (D., V.); Ceylon (B.).

A. ocellata (Klz.) Brook, p. 148.
Red Sea (Kl., V.); Ceylon (B.).

**A. pachycyathus* Ver., sp. nov. See notes, below.
Locality unknown, Indo-Pacific (V.).

A. Pacifica (Brook, p. 39).
Samoa I. (type), and Tizard Bank (B.).

**Acropora paniculata* Ver., sp. nov. See notes, below.
Fiji or Tahiti (V.).

A. parvistella (Ver. 1864 = ? *M. microphthalma* B., *non* Ver.), Brook, p. 197. See notes, below.
Singapore (V.).

**A. paxilligera* (D., *non* Q.) Brook, (*pars*) p. 74.
Tahiti (D., V., B.); Fiji and Mergui Arch. (B.).

A. Pharaonis (E. and H.) Brook, p. 58 = *microcyathus* Kl.
Red Sea (E. and H., B., Kl., V.); Indian O. and Keeling I. (B.).

A. plantaginea (Lam., *non* D., t. Brook). Brook, p. 156.
Tahiti; Samoa, Tongatabu, and Ceylon (B.).

A. pocillifera (Lam., D.) Brook, p. 61, descr. from Lam., type.
Tongatabu (Lam., B.); Tahiti (Q., B.); Fiji (B.); New Hebrides, and G. Barrier Reef (B.).

**A. polymorpha* (Brook), p. 169 = *M. abrotanoides* D., *non* Lam.). See notes, below.
Fiji ? (D.); Malacca (B.).

**A. prolixa* (Ver. *non* = *longicyathus*, as in Brook, p. 187. See notes, below, and figure.
Ousima (V.).

**A. prostrata* (D., *non* Q.) Brook, p. 119.
Sulu Sea (D.); ? Fiji (D., B.); ? G. Barrier Reef (B.).

**A. pumila* (Ver.) Brook, p. 166. See notes, below, and figure.
Bonin Is. (V.).

A. (*Isopora*) *palifera* (Lam., Brook from type, *non* D.) Brook, p. 131 = *M. labrosa* D., t. Brook.
Sulu Sea (D., B.); China Sea, Solomon Is., Diego Garcia, New Guinea, Tizard Bank, Queensland, and G. Barrier Reef (B.).

**A. pyramidalis* (Klz.) Brook, p. 150.
Red Sea (Kl., V., B.); Mauritius, Mergui Arch., Pelew Is., Caroline Is., China Sea, and G. Barrier Reef (B.).

**A. ramiculosa* (D., *non* Q., *nec* Ortm.).
Fiji (D.).

**A. retusa* (D.) Brook, p. 77.
Fiji (D., B.); Tahiti (B.).

A. robusta (D.) Brook, p. 42.
Fiji (D., B.).

A. rosacea (Esp., Stud., Q.) Brook, p. 84. See *dissimilis*, and notes, below.
Ternate and Samboangan (Q., B.).

**A. rosaria* (D.) Brook, p. 179.
Fiji (D.); Tahiti; Samoa, Louisade Arch, Caroline Is., Tongatabu, and G. Barrier Reef (B.).

**A. Samoensis* (Brook, p. 143).
Samoa (B., V.).

**A. scandens* (var. of *Ehrenbergii*, t. Brook, p. 49). See notes, below.
Red Sea (Kl., V.).

**A. secale* (Stud., *non* Q.) Brook, *pars*, p. 87, = *M. plantaginea pars*, D., *non* Lam. See notes, below.
Ceylon (D., V.); Singapore? (B.); ? China and Tizard Bank (B.).

**A. secaloides* Ver., sp. nov. See notes, below.
Singapore (D., V.).

**A. secunda* (D., *non* Brook). See under *A. nobilis*, var., and notes, below.
Singapore (D., V.).

**A.* (*Isopora*) *securis* (D., *non* Q., t. B.) Brook, p. 133.
E. Indies? (D.); Solomon Is. and Amirante Is. (B.).

**A. seriata* (Ehr., D.) Brook, p. 149 = *pallida* and *pyramidalis* (*pars*) Klz., t. Brook.
Red Sea (Ehr., Kl., B.); Mauritius, Mergui Arch., Ceylon, and G. Barrier Reef (B.).

**A. Solanderi* (Def.).
Tertiary of France.

A. spectabilis Brook, op. cit., p. 141, pl. xviii, fig. B.
Locality of type unknown (B.).

**A. spicifera* (D.) Brook, p. 92 = *microclados*, *pars*, Ehr., Stud.
Singapore (D., V., B.); Fiji (D., B.); Tahiti (D., V.); Ceylon (D., V., B.); Tizard Bank, China Sea, Gulf of Aden, Mergui Arch., Tongatabu, New Ireland, New Guinea, New Caledonia, and Solomon Is. (B.).

**A. squamosa* (Brook, p. 120, pl. xx, fig. B.). See notes, below.
Singapore (B., V.); G. Barrier Reef (B., type).

A. squarrosa (Ehr.) Brook, p. 65.
Red Sea (E., Kl., B., V.); Pelew I., Ponapé, Tahiti, and Australia (B.).

**A. stellulata* Ver., sp. nov. See notes, below.
Zanzibar (V.).

**A. striata* (Ver.) Brook, p. 178. See notes, below.
Ousima? (V.).

**A. subulata* (D.).
Singapore (D., V., B.); New Guinea (B.).

**A. subtilis* (Klz.) Brook, p. 68.
Red Sea (Kl., V., B.); Solomon Is. (B.).

**A. surculosa* (D.) Brook, p. 104. See notes, below.
Fiji (D., B.); Singapore (D., V., B.); Mergui Arch., and G. Barrier Reef (B.).

**M. symmetrica* (Brook, p. 94, pl. xv). See notes, below.
Mauritius (B., type); Zanzibar (V.).

**A. tenuis* (D.) Brook, p. 83.
Locality of type unknown (D.); Samboangan and G. Barrier Reef (B.).

A. teres (Ver.) Brook, p. 198.
Ousima (V.).

**A. tortuosa* (D.) Brook, p. 71.
Fiji (D.); Caroline Is. (B.).

**A. tubigera* (Horn, *non* Quelch, *nec* Brook, p. 79). See notes, below.
Singapore (V.). Type examined.

**A. tubicinaria* (D.) Brook, p. 139.
Fiji (D.); Tahiti (V.).

**A. tubulosa* (Ehr.) Brook, p. 175.
Red Sea (Ehr., Klz.); New Guinea, Carolina Is., and Malacca (B.).

**A. turbinata* Var.? See *A. surculosa*, and notes, below.
Tahiti (D., type in Yale Mus.).

**A. tumida* (Ver.) Brook, p. 163. See notes, below.
Hong Kong (V.); China (B.).

A. turgida (Ver.) Brook, p. 198.
Loo Choo Is. (V.).

**Acropora urceolifera* Ver., sp. nov. (=*M. corymbosa* D., *non* Lam.).
E. Indies (D.).

A. valida (D.) Brook, p. 168.
Fiji (D., B.); Tongatabu, Torres St., Mergui Arch., and Singapore (B.).
**A. variabilis* (Klz.) Brook, p. 161=*coalescens* Ort., t. Br.
Red Sea (Kl., V.); Ceylon, Macclesfield Bank, Samoa, Tongatabu, and G. Barrier Reef (B.).
**A. virgata* (D.) Brook, p. 40.
Fiji (D., B.); Tahiti (B.); New Hanover, Amboina, and Tongatabu (B.).
**A. Wardii* Ver., sp. nov. See notes, below.
Indo-Pacific (V.).

The localities of numerous specimens of species included in the above list, that I have studied, were doubtful or unknown, many of the specimens having been bought from dealers. In such cases I have omitted the doubtful localities, adding only those that seemed to be authentic.

Probably many of the localities given by others, and quoted here, are not altogether reliable, for the same reasons.

Another source of error lies in the various modes of cleaning and bleaching the specimens. Chemicals are sometimes used that injure the delicate parts. Long exposure to the weather, as in bleaching them, always destroys or changes the delicate septa, margins of the calicles, and especially the fine spinules of the surface.

Acropora acervata (Dana) Ver. See p. 212.

Madrepora acervata Dana, Zoöph., p. 460, pl. xxxiv, fig. 4, 1846. Brook, Cat. Madreporarian Corals British Mus., i, p. 147, 1893.
?*Madrepora amblyclados* Brook, op. cit., p. 140.

PLATE XXXVI. FIGURE 17. PLATE XXXVI B. FIGURE 8.

Brook assumed, without due evidence, that my (1864) determination of Dana's species was incorrect and that I had a distinct species in view. However, I had Dana's types in my hands for comparison, and still have some branches that he specially described, for the details.

Brook merely quotes Dana's description and records no additional specimens. This indicates that he had not identified the species, although it is a common one at Singapore. Doubtless he has it under some other name or names in his catalogue.

Brook was, however, probably correct in stating that Dana's species is not the same as *M. plantaginea* Lam., as described by him from a specimen supposed to be one of Lamarck's types. But it was probably included under that heterogeneous species by Lamarck and by Edw. and Haime.

This species forms broad convex clumps of rather stout, upright, more or less divided, obtuse branches, with a large, swollen axial corallite. The clumps arise from a broad, short basal mass; the outer and under ones are curved and spread out nearly horizontally in the larger specimens, and they often become flattened, irregular, and more or less coalescent, but they may be much coalescent on one side of a clump and entirely free on the other. In young specimens the outer branches are less spreading, or more upright, and do not coalesce. The central branches of the upper side are mostly 60 to 70^{mm} long, often forked at the base, and may give off two or more small divergent, ascending branches from the middle portion, or distally. The calicles of the horizontal branches and bases of the upright ones are mostly immersed, but rather large and conspicuous, with a very distinct star of six primary septa, the directives larger. Our largest specimen (No. 6118, from Singapore) is a foot in diameter (300^{mm}), and half as high. I have seen others considerably larger, from Singapore.

The axial corallites are large (4^{mm}), very short, obtuse, with very thick, openly porous walls, and a rather small calicle (1^{mm}), which has a distinct star of 12 septa, the directives wider. The lateral calicles are various in size and form. The larger ones are large and thick, tubular, strongly ascending, but not much appressed, with the distal margin obliquely truncate, so that the margin of the calicle is very oblique.

The outer side of these calicles is much thickened and rounded at the outer lip, so that the corallites often appear slightly scaphoid; in some cases they are somewhat appressed, but usually the inner lip is fairly well developed, though much shorter and thinner than the outer. The star is very distinct, usually with 12 septa; the six primaries are wide, the directives broader; those of the second cycle are very narrow and thin, often absent. The exterior wall of these corallites is porous and densely echinulate-costate, the small spinules being arranged in costal lines.

Among the larger corallites are many others that are equally wide, but much shorter, more divergent, the calicles opening more outward, but with a similar thick outer lip and star. Lower down many are verruciform and a few small ones are immersed.

The cœnenchyma of the branches is firm, but somewhat porous, and covered with sharp or blunt rough spinules, which are not very fine nor very closely arranged; in some places it becomes reticulate-porous.

Singapore (D.; V., type). Several perfect specimens are in the Museum of Yale University (coll. Capt. Putnam and others) from Singapore. I have studied others, from the same sources, in the Mus. of Comp. Zoölogy; the Peabody Inst., Salem, Mass.; the Field Columbian Museum, etc. Nos. 1777, 6118, Yale Mus.

In mode of growth and general appearance this species resembles *A. Studeri* (Br.); *A. diversa* (Br.); *A. bullata* (Br.); and *A. fruticosa* (Br.), but in the details of the corallites it does not appear to agree very well with either of these.

Acropora appressa (Ehr.?) Dana. See p. 212.

Madrepora appressa Dana, Zoöph., p. 457, pl. xxxi, fig. 8; pl. xxxiv, fig. 5, (? *non* Ehr., t. Brook).
Madrepora assimilis Brook, op. cit., p. 85, pl. xx, fig. A.
Madrepora alliomorpha Brook, op. cit., p. 87.
? *Madrepora appressa* Ehr., redescribed by Brook from type, op. cit., p. 87.

PLATE XXXVI D. FIGURE 4. PLATE XXXVI E. FIGURE 4.

Fragments of the type of Dana are in the Yale Museum. No. 2029. Also numerous excellent specimens, of various ages, from Singapore, which agree perfectly with the type. Nos. 1, 3, 5, 6, 8, 11, 1371, 1383, 5541.

When young (up to 100 to 150^{mm} broad), this species does not have the branches of the under side coalescent, or else they are only slightly so. In this stage of growth the branches form a rounded convex clump of much divided branches, arising from a stout basal mass, the outer ones spreading and proliferous. Small branchlets are also given off on the under side and soon begin to be appressed and flattened, losing their prominent calicles. Gradually, as they become more flattened and crowded, they begin to coalesce, openly at first, but eventually, in large specimens, they may form a nearly continuous plate, with few irregular openings through it, toward the margins, as described by Dana.

The immersed calicles of the under side are few, scattered, small (0.5^{mm}), but distinctly stellate, usually with 12 septa, the secondaries narrow.

The fragments from Dana's types apparently came from two specimens. They have the following characters:

The axial corallites are small (1.5 to 2^{mm}), and about 1–2.5^{mm} exsert; walls not swollen, calicle with 12 septa. The radial corallites are mostly strongly appressed and imbricated, seldom arranged serially, but rather in quincunx. The more distal ones are somewhat spreading, mostly compressed, tubo-nariform, the larger ones 4–5^{mm} long, 1.5^{mm} broad, with the aperture very oblique and elliptical; the inner lip may be wanting, or short and thin; the outer lip is elongated, a little thickened, either obtusely rounded or narrowed, usually a little incurved, both laterally and distally. The radial corallites, a little lower down, gradually become more appressed, with the outer lip narrower and more pointed, and the inner lip abortive. The wall of the distal corallites is strongly grooved and costulate, with sharp-edged and finely echinulate costulæ; those lower down have less prominent costulæ, and larger, rough or sharp granules in series; the lower lip is perforate between the costulæ. Toward the base of the branchlets the corallites become much shorter, closely appressed, but still tubular, with nearly round calicles. On the larger basal branches there are many immersed calicles, with a very distinct 12-rayed star, and many others with a slightly raised border. These calicles are very distinctly stellate with six wide and six narrow septa, and are 0.75 to 0.8^{mm} in diameter.

All the radial calicles have six strong primary septa, the directives wider, and six narrow secondary ones.

The cœnenchyma is firm, but porous, and roughly echinulate, with rather large, sharp granules, often in series.

The specimens from Singapore agree well with the types in the size and form of the branches and corallites, but the walls of the corallites often lack the costulæ and are densely covered with fine sharp granules, which may be in series; but in most cases the distal and less appressed corallites are more or less costulate, even when those below are evenly echinulate. In some of these specimens the outer lip of the larger radial corallites is thicker and more convex, so that the form is slightly scaphoid.

But in the large series of specimens examined, there are all intermediate states and many other variations.

Hence I am led to doubt the distinctness of *A. appressa* (Ehr.); *A. assimilis* (Br.); and *A. alliomorpha* (Brook), all of which are certainly much alike.

Brook, himself, refers Dana's *appressa* to his *assimilis*, but the general figure of the latter (from a photograph) shows some differences. The most notable is the very evident arrangement of the corallites in vertical series, which I have not observed to any marked extent in the Singapore specimens. The type photographed by him is from Macclesfield Bank. To me it seems much like *M. alliomorpha* Brook.

The true *appressa* Ehr. has been redescribed by Brook from the type in the Berlin Museum. It has not been figured. It seems to agree pretty closely with Dana's species in most respects, but has larger axial and radial corallites than I have observed in the latter. According to Brook the larger radial ones are up to 8^{mm} long and 2^{mm} thick; the axial $2–2.5^{mm}$ in diameter. I can find no other marked difference, and possibly this is not beyond the limits of variation in this species, for many others are known to vary more than this in the size of the corallites. The upright branches are shorter than in Dana's type (one inch long, t. Ehr.; $4–6^{cm}$, t. Brook).

Brook also states that the wall is "dense and echinulate, not striate." I have shown above that this character is variable in Dana's form. According to Brook the radial corallites are mostly "hooked labellate, with a thick, blunt, and frequently incurved apex." The larger size of the axial corallites (t. Ehr.) formerly led me to suppose that it might be identical with *M. acervata* Dana, but the measurements given by Brook would seem to contradict this, unless the type be undeveloped in this respect; but Ehrenberg states that it is nine inches in diameter.

The distinctions between *assimilis* and *alliomorpha* seem to me very slight and at most only varietal. See also *A. dissimilis*, below.

Acropora arbuscula (Dana) Ver. See p. 213.

Madrepora arbuscula Dana, Zoöph., p. 474, pl. xl, fig. 2, 1846. Brook, op. cit., p. 40.
? *M. laxa* Lam., Brook, p. 46.

This species, in a large series from Singapore, shows much variation. There are two branches of Dana's type from the Sulu Sea, in the Yale Museum (Nos. 2005, 4165) besides a good series from Singapore.

The type differs a little from most of the latter in having the radial corallites rather shorter and more squarrose, with the walls more porous and more distinctly costulate. But these characters vary in this species.

In the type the radial corallites of the upper side of the branch are rather crowded, subequal, short (about $2–3^{mm}$ long and 2^{mm} broad), tubular, with lower wall a little thicker, obliquely truncate, and with the aperture terminal and a little oblique, owing to the thinner and shorter inner lip. The outer lip is distinctly thickened, rounded, but not incurved. The wall is covered with elevated thin costulæ, which become echinulate lower down, and on the degenerate corallites of the lower side of the branch.

The cœnenchyma is porous-reticulate, or vermiculate-pitted, and sparingly granulated.

The Singapore specimens are variously arborescently branched, with rather few divisions, most of the branches not over 16–20^{mm} thick. The corallites are often few and degenerate on the under side, but generally they are crowded and rather long on the upper side.

The radial corallites stand at various angles, even on different branches of one specimen. Most commonly they are ascending and stand at 45° to 60°, but they may stand at 90°. They are commonly nearly terete, tubular, a little tapered, truncate, with the aperture terminal and often only slightly or not at all oblique, but in other cases decidedly oblique, as in the type. The larger ones are often 4–5^{mm} in length and 2.5^{mm} wide at base. Between these there are usually many short, verruciform, or subconic corallites.

All the calicles are very distinctly stellate, usually with 12 septa, the primaries well developed, with wider directives; the secondaries thin and narrow. The outer wall is generally distinctly thickened, and the outer lip a little prominent and rounded, but not incurved. Externally the wall of most of the calicles is densely covered with minute granulations, generally in longitudinal lines, but sometimes uniformly arranged, giving the surface a smoothish appearance. On the younger calicles distinct costulæ are often present, but they are seldom so distinct as in the type.

The cœnenchyma is also generally very finely and closely echinulo-granulate, like the corallites, but in many parts it becomes pitted, as in the type.

Some specimens occur in which the corallites of the larger branches and proximal parts of the smaller ones are short-conical or verruciform, with crowded, swollen bases, unequal in size, and in contact, with small, terminal, stellate calicles, 0.5^{mm} in diameter. But on the distal parts of the branches corallites of the ordinary form occur.

This variety has the cœnenchyma and corallites densely echinulo-granulate. It seems to grade into the ordinary varieties, though the small size of the calicles is a striking character.

At first sight the Singapore variety looks like a distinct species, owing to the fine, dense granulation of the surface, and the longer and more tapered corallites. But some of the specimens have branches showing almost exactly the structure of the type, though other branches may be as usual. Therefore I conclude that the difference is at most only a local variation.

M. laxa Lam., as described from the type by Brook, seems to differ very little from the Singapore variety of this species, and it may, perhaps, be identical. It has not been figured.

Acropora austera (D.) Ver. See p. 213.

Madrepora austera Dana, Zoöph., p. 478. Brook, p. 56.

PLATE XXXVI. FIGURE 10. PLATE XXXVI B. FIGURE 1.

Branches of Dana's type are in the Yale Museum. These show that the axial corallites have thick reticulate walls and 12 wide, thin septa, the 6 primaries nearly meeting. No. 4190.

The radial corallites also have 12 septa, the secondaries narrow.

The walls of the larger corallites are very porous and costulate, but the costulæ are thin and spinulose, and more or less interrupted by the larger pores between them; toward the margin, the walls are often reticulate or fenestrate, owing to the large pores. But the smaller radial corallites often have the walls strongly and roughly echinulate, without costulæ.

The surface of the cœnenchyma is openly porous or reticulate, and very scabrous, with coarse and irregular spinules.

I have seen no specimens, except Dana's type. Brook, apparently, had no specimens of it, unless he put them under some other species, as is not improbable. He refers to it, doubtfully, some worn fragments only.

Acropora dissimilis Ver., sp. nov.

Madrepora echidnæa Dana, Zoöph., p. 458, pl. xxxi, fig. 9, pl. xxxv, fig. 3, 1846, *non* Lam., Ehr., Stud.

Madrepora rosacea Studer (*pars*). Brook, op. cit., p. 84, (*non M. rosea*, as on pl. xv, *nec rosacea* Esper, p. 115).

PLATE XXXVI. FIGURE 9. PLATE XXXVI A. FIGURE 9.

Studer was undoubtedly correct in stating that the *A. echidnæa* (Lam., and of Ehr.) was a very distinct species from Dana's, but he was wrong in uniting the latter with Esper's *M. rosacea*, which has very exsert radial corallites.

Dana's species is closely allied to *cerealis*, *appressa*, and *assimilis*.

It has unequal, tubular, loosely arranged, distal radial corallites; the longer ones but little appressed, and with oblique margins; the calicles open inward and upward.

It has slender, acute, elongated, proliferous branches, with rather small axial corallites, about 3^{mm} in diameter and 1 or 2^{mm} exsert, with porous walls and a small, 12-rayed calicle.

The radial corallites are loosely, irregularly arranged, and very unequal in length. On the distal $25–40^{mm}$ there are many, longer, ascending, tubular corallites, somewhat incurved, not appressed, with the aperture oblique. The larger of these, which are free distally and bear one to several small basal buds, may be 6 to 8^{mm} long and $1.75–2^{mm}$ in diameter; some of them give rise to small ascending proliferous branches.

Between these are other tubular and tubo-nariform radial calicles that are about as large, but not so long, attached for nearly the whole length, but not appressed, or only slightly so, with the aperture oblique, round or slightly elliptical, and directed upward, and without a free inner lip. Part of these are somewhat compressed, with the outer wall thickened and convex; others are nearly round and straight, but all have the outer lip thickened, prominent, obtuse, sometimes slightly incurved, sometimes straight.

The corallites are about $3–5^{mm}$ long and 1.75^{mm} in diameter. Others mixed with these are one-half shorter, with the aperture less oblique. The wall of the distal corallites is echino-costulate; that of the more proximal ones is densely echino-granulate, usually with the granules in series.

On the proximal half of the branches many of the corallites are immersed or have only short appressed lips; on the larger branches they are nearly all immersed, with small stellate calicles.

The radial calicles all have about 12 narrow, unequal septa, the directives a little wider. The cœnenchyma is uneven, pitted, and roughly granulated.

This species is related to *M. alliomorpha* and *M. assimilis* Brook, =*M. appressa* Dana, but seems to be distinguishable on account of its much longer and very unequal radial corallites, which are not so much appressed.

In the length of the radial corallites it is more like the typical *appressa* of Ehr., but that is said to have the corallites strongly appressed and not striate.

As it cannot properly be referred to *A. rosacea* (Esper), I propose to give it, for the present at least, a new name (*A. dissimilis*). Future comparisons with the types may lead to the union of this and several of the allied forms. The union of this and *appressa* (Dana) was suggested by me in 1864, but at present the tendency seems to be to separate the allied forms of this group, rather than to unite them. Still I think it not unlikely that a larger series of specimens would compel us to unite them in one species.

Acropora diffusa Ver. See p. 214.

Madrepora diffusa Verrill, Bull. Mus. Comp. Zoöl., i, p. 41, 1864. Quelch, op. cit., p. 161. Brook, op. cit., p. 80.

PLATE XXXVI C. FIGURE 2. PLATE XXXVI F. FIGURE 16.

The larger radial corallites in this species are prominent, compressed, nariform, standing at about 45° to 60°, not at all appressed. The outer lip is thickened, a little incurved and considerably longer than the thin inner lip. The free part of the inner wall is short but evident, thin. The aperture is oblique and elliptical. Six very narrow primary septa are visible ; the directives are a little wider than the others. The walls are firm but porous and roughly echinulate ; the sharp granules are often in costal lines, but usually no distinct costulæ are visible, unless on very young corallites.

The axial corallites are a little exsert and scarcely larger than the radial, with a small calicle (0.75 to 1^{mm}). The primary septa are well developed, but thin.

Kingsmills Is., cotypes. No. 1808.

Acropora digitifera (Dana) Ver. See p. 214.

Madrepora digitifera Dana, Zoöph., p. 454, 1846. Brook, op. cit., p. 75, 1893.

PLATE XXXVI. FIGURE 12. PLATE XXXVI B. FIGURE 3.

Several branches of the type-specimen are in the Yale Museum (No. 430). These were, in part, used by Dana in describing the details of the calicles. The longer branches are $50–65^{mm}$ long, and $10–13^{mm}$ in diameter at base, somewhat curved and compressed, proliferous, with small normal branchlets on the distal third.

Near the base the calicles are small and many of them are wholly immersed, deep, with 12 very narrow septa ; others are larger, with a squarrose, short, thick, spout-like lower lip ; the upper lip is abortive, or nearly so.

The most fully formed, radial calicles (2 to $2{\cdot}2^{mm}$ in diameter) are on the distal half of the branches ; these are large, strongly squarrose, or stand nearly at right angles to the branch. They are spout-shape, rather prominent, with the lower lip thick, expanded, well rounded, and not at all contracted ; the upper lip is short and thin. They have a distinct star of 12 septa, all of which are narrow except the two directives. The outer wall is covered with numerous, very thin costulæ.

The more distal corallites are a little more ascending, but the lower lip is slightly excurved and expanded, so that the calicles are conspicuous. Some smaller immersed calicles (0.3^{mm} in diameter) are found between the labiate ones nearly to the tips of the branches.

The axial corallites are moderately large (2.5 to 3^{mm}), with thick walls, and only a little exsert. The axial calicle is small (1^{mm}), with 12 subequal, thin, but not narrow, septa.

The cœnenchyma of the branches is rather dense, with few small pores, and its surface is covered with rather coarse, rough or sharp spinules, not crowded, and mostly arranged in longitudinal series, or often united into irregular costulæ or small tabulæ.

The origin of the type is unknown, but is doubtless Indo-Pacific.

Acropora effusa (Dana) Ver. See p. 215.

Madrepora effusa Dana, Zoöph., p. 455, 1846. Brook, p. 76 (*non* Quelch).

PLATE XXXVI. FIGURES 16, 16*a*. PLATE XXXVI B. FIGURES 7, 7*a*.

Dana's unique type of this species from Ceylon (coll. Rev. Geo. H. Apthorp) is in the Museum of Yale University.

It is a regular corymbose clump, with a slightly convex surface, 10 by 14 inches (250×350^{mm}) across, and 5 inches (125^{mm}) high. The upper surface is covered with upright branches 25 to 40^{mm} long, arising from a solid basal mass of cœnenchyma, covered above with immersed stellate calicles. The base is broadly incrusting, about 250^{mm} across, and free marginally only for a slight distance, except on one side, where the free part is 75 to 100^{mm} wide. It here forms a nearly solid plate of coalesced branches, with a few submarginal openings, without free branchlets, but covered thickly with exsert, conoidal, verrucose, and tubular corallites, 1–3^{mm} long, with porous, echinulate walls and 6-rayed, stellate calicles, the directives wider. There are few immersed calicles beneath. The cœnenchyma of the outside base is very porous.

The marginal branches are nearly horizontal at base, and coalescent; submarginal ones are curved upward distally; those nearer the middle are straight, upright, partly simple and partly forked, or more or less proliferous; they are rather stout and tapered, 10 to 15^{mm} thick at base, subacute, with a moderately large, but not swollen, axial corallite, 2.5–3.5^{mm} in diameter, and 1–3^{mm} exsert, with rather thick, openly porous, costulate walls.

Many of the proliferous branches bear rather numerous, large, tubular corallites, mostly with a few small basal buds, some of them thus forming the axial corallites of incipient branchlets, 8 to 12^{mm} long. The gemmiferous corallites are much like the axial, regular tubular, with the calicle terminal, and the walls rather thick and costulate. Septa 12, all narrow, the directives a little wider.

Radial corallites of various sizes intermixed. The larger ones are tubular, round or slightly compressed, many of them tubo-nariform; many are dimidiate or spout-shaped; others have the aperture subterminal and oblique. The outer lip is usually prominent, a little thickened, and often slightly incurved, but in others the lip is shorter and straight; many have the inner lip short, or abortive, but in others it is well developed and thin. The smaller intermixed corallites have the same forms but some are short verruciform, others labellate; immersed ones are few, except at the base.

The walls are reticulate-porous and regularly costulate or echinocostulate on the distal corallites, but often evenly and sharply granulated on those of the lower portion of the branches. The basal corallites are mostly short, verruciform, with the calicle terminal. Septa in nearly all cases are 12, but narrow; those of the first cycle are fairly well formed; those of the second are very narrow, sometimes rudimentary; directives are rather wider than others.

The longer tubo-nariform calicles are about 3 to 4^{mm} broad and 2^{mm} in diameter; many of these are gemmiferous at base.

Point Pedro, Ceylon, coll. Rev. G. H. Apthorp, 1843. No. 3063.

This species, in its form and mode of growth, resembles *A. Studeri* (Br.), but the latter forms more regularly corymbose clumps, with shorter and more conical branches, and its corallites seem to be more divaricate and more labiate. *A. bæodactyla* (Br.), pl. xiii, also has a similar form, but the corallites are quite different. It is closely allied to *A. secale* (type from Ceylon).

Acropora indurata Ver., sp. nov.

Plate XXXVI. Figure 19. Plate XXXVI C. Figure 6.
Plate XXXVI F. Figure 12.

Coral dense and heavy, sparingly branched, with short, stout branches, somewhat as in *A. robusta* Dana. Branches often 25^{mm} or more in diameter, subconic, or gradually tapered, obtuse.

Axial corallites short, scarcely larger than the radial ones and not much different in form; 3–3.5^{mm} in diameter, 1 to 2^{mm} exsert; walls moderately thick and lips rounded; calicle small (about 1^{mm}), with 12 septa distinct.

Radial corallites irregularly arranged, crowded and exsert on the upper side; loosely arranged below, and less exsert; on the smaller branches more regular and ascending, nearly aduate, but not appressed. On the larger branch they stand at angles varying from 30° to 60°, and sometimes form oblique rows. They are verruciform, conoidal, or tubo-conoidal, with thickened walls and swollen base; summit usually obliquely truncated, with the small calicle opening upward; but sometimes it looks downward, or sideways, and often it is terminal.

Length of the larger radial corallites, mostly 3 to 4^{mm}; diameter at base, about 3^{mm}; calicles, 0.75 to 0.80^{mm}.

The distal end of the radial corallites is usually free for 1 to 3^{mm}, with the inner lip well formed, but some are entirely aduate, with no free inner lip. No immersed calicles occur on this specimen.

The radial corallites are strongly stellate; the six primary septa are well developed, but narrow, thick next the wall, subequal; the secondaries are much smaller, but distinct. The whole surface is uniformly and densely covered with fine rough granules.

The type is a single stout branch, 100^{mm} long, with one side branch 20^{mm} long. No. 6155, Mus. Yale Univ. Australia (coll. Ward). The rest of the specimen, on which I made my notes several years ago, may now be in the Field Columbian Museum, Chicago.

This species is remarkable for the unusual density of its cœnenchyma, and for its conoidal radial corallites.

Acropora Luzonica Ver., sp. nov.

PLATE XXXVI C. FIGURE 4. PLATE XXXVI F. FIGURE 9.

Coral arborescent, distantly, loosely, and irregularly branched, with the branches often forked, mostly ascending, but some are widely divergent and often crooked. The terminal branchlets taper gradually to rather slender tips. Principal branches are mostly 12 to 15^{mm} in diameter at base; terminal ones are 6 to 10^{mm} thick at base, and up to 60 to 75^{mm} long. Their tips are subacute, truncate, with the axial corallite 2 to 3^{mm} in diameter and 1 to 3^{mm} exsert, walls are not very thick, reticulate-porous, and strongly costulate.

The radial corallites are mostly entirely or nearly immersed, on all the larger branches; some of them have slightly raised, thin margins; others have the lower lip a little prominent; their calicles are rather large (1 to 1·25^{mm}), and regularly stellate, with six well-developed primary septa and six narrow ones; the directives nearly meet in the center.

On the more distal parts, and especially on the terminal branches, the margins of the calicles become more elevated, especially on the lower side, forming thin lower lips that stand out often nearly at right angles, but unevenly so, thus giving the surface a rough and irregular appearance.

Those near the ends of the branches are often tubular, but entirely adnate, with the large, terminal, round calicles opening upward; the inner lip being thin and very short or adherent, while the thin outer lip is tubular and truncate. A little lower down the inner lip is suppressed and the outer lip is shorter and often half-tubular or dimidiate, but the calicles are nearly round and often open rather outward, so that they are conspicuous in a side view. They are rather crowded and unequal in size, the larger ones being about 1.25^{mm} in diameter. All the larger ones have 12 septa, but the septa may all be rather narrow, except the directives, which are usually well developed.

The walls are always thin, compact, and strongly costulate. The cœnenchyma is firm but porous, irregularly pitted, and covered with rather loosely arranged, small, rough granules.

Manilla Bay, Luzon. The type is in the Mus. Yale Univ. (No. 1809, orig. number 198), received from the Museum of Comp. Zoölogy, where there were formerly many specimens.

This species belongs to the subgenus *Eumadrepora* of Brook. It is, perhaps, more nearly allied to *Acropora pulchra*, var. *stricta* Brook, than to any other form described by him, but the latter has smaller and more tubular corallites, and the surface is "closely reticulate."

Acropora microphthalma Ver. See p. 216.

Madrepora microphthalma Verrill, Comm. Essex Inst., vi, pp. 83, 102, [49, 68,] 1869. Brook (*pars*), p. 168.

Plate XXXVI C. Figure 1. Plate XXXVI F. Figure 15.

The specimens referred to this species by Brook (p. 169) appear to be quite distinct. They are "laxly arborescent; branches elongate, 2^{cm} thick; scarcely tapering," and have much larger radial corallites, which are "dilated, tubular," with the inner part of the wall "often incomplete or absent."

None of these characters apply to my original type, which is in the Yale Museum (No. 774). This is a very much branched, small, arborescent coral, with the branches small (larger ones about 10^{mm}), strongly divaricate, and very proliferous, especially distally. Many of the smaller branchlets stand nearly at right angles to the branches; others at 45° or less.

The axial corallites are small (1.75 to 2^{mm}), not swollen, a little exsert, slightly tapered, with the wall porous and finely echinulate, rarely echino-costulate.

The radial corallites are very unequal in size and form, but all are small. The larger ones ($1.5–2^{mm}$) are nearly regularly tubular, a little tapered distally, obtuse at the end (about 3^{mm} long), with the calicle small and only slightly, if at all, oblique, and about 0.5 to 0.6^{mm} broad, with thickened walls. The six septa nearly meet in the center; rudimentary ones of the second cycle are often present, but minute. These larger corallites mostly diverge at an angle of 45° or more, except distally.

Between the larger ones are many smaller subconical or verruciform corallites, standing at various angles, with the terminal calicles only 0.3 to 0.4^{mm} in diameter, while others, like small, rounded verrucæ, have calicles of only 0.2^{mm} diameter, but yet show six septa.

The corallites and cœnenchyma are densely covered with minute sharp granules, and show but few pores.

The type of *A. microphthalma* was from the Loo Choo Islands.

The specimens described by Brook were from Korea, Torres St., and Ramesvaren. They may, perhaps, belong to *A. parvistella* (Ver., 1864).

Acropora nobilis (Dana) Ver. See p. 217.

Madrepora nobilis Dana, Zoöph., p. 481, pl. vi, fig. 3, 1846, × *M. secunda*, var., p. 481, pl. xi, fig. 4. Verrill, Bull. Mus. Comp. Zoöl., i, p. 40, 1864.

A good Ceylon specimen (No. 454) of this species, which was used by Dana in his description, is in the Yale Museum, and also a branch of his East Indian (Singapore) type. Also, one of his types of *M. secunda*, from Singapore (No. 2014).

In addition to these, there are numerous good specimens of this species from Singapore (coll. Capt. W. H. A. Putnam and others). I have also seen large series in other museums.

The Ceylon specimen is a low clump of short, stout branches, up to $25–30^{mm}$ in diameter, arising from a large basal mass. The branches divide rapidly and irregularly, so that the undivided terminal branches are mostly only 25 to 50^{mm} long, and taper rapidly. They stand at various angles ; some are almost squarrose.

Most specimens grow taller (up to 2 feet high $=600^{mm}$) and branch more arborescently, with longer and more distant branches, variable in size. This was the case with Dana's Singapore type.

But the characters of the corallites are generally pretty constant in all. The axial corallites are nearly always large and swollen, with thick, porous walls; their diameter is commonly 4 to 5^{mm}, but varies from 3 to 6^{mm} on a single specimen; their calicles are about 2^{mm} broad ; the naked, exsert portion may be 2–3^{mm} in length.

The radial corallites are various in size and form on one branch. The larger ones, in typical *nobilis*, are dimidiate-cylindrical or spout-like, scarcely at all compressed, with the lower lip thick and rounded, rather long, porous, often slightly expanded, frequently a little incurved, but distally on the branches more spreading and often a little excurved, though the greater number are nearly straight on the outer side; they stand at angles of 50° to 90°, but more generally at 60° to 70°. The inner lip is usually short and thin. The larger ones are usually about 2–2.5^{mm} broad and 2 to 4^{mm} long.

Their septa are very distinctly stellate, with six rather wide primary septa, the directives wider, and six narrow ones of the second cycle. The axial corallites have 12 distinct septa, rarely 24.

The walls of the axial and radial corallites are strongly costulate, with pores between the costulæ ; the lower lip of the radial corallites is fenestrate-porous distally. The cœnenchyma is very porous and pitted, and roughly granulated.

Between the larger radial corallites there are many small labellate or dimidiate ones, with the outer lip either long or short, straight or incurved, and also a few that are nearly or quite immersed.

Var. **secunda** Ver., 1864.

Madrepora secunda Dana, op. cit., p. 487, pl. xl, fig. 4.

One of Dana's types of this form, in the Yale Museum, forms a loosely, arborescently branched clump, about 10 inches high (250^{mm}), with the main branches rather long and divergent, about 15 to 18^{mm} in diameter, branching freely distally, with evenly tapered branches.

In its form and mode of branching it does not differ from many typical specimens of *nobilis*, but the main branches are more slender than usual.

The terminal or axial corallites are thick and swollen, porous, and costulate, formed exactly as in *nobilis*, though they average rather smaller, but several of the branches have them as large as is usual in typical *nobilis;* they vary from 3 to 5^{mm}, the average being about 3·5 to 4^{mm}.

The structures of the cœnenchyma and walls are as in *nobilis.*

The lateral corallites are rather smaller than usual in that form, and they are mostly distinctly compressed, and have the outer lip less thickened, and more often incurved, so that many of the corallites are slightly boat-shaped, and the calicles elliptical; but they are cut away on the upper side and have the short inner lip as in *nobilis.*

Moreover, on some branches of the type, the calicles are not more compressed than often occurs on typical *nobilis.* This character varies in this species, as in many others, and may be due to more or less crowding of the buds.

This more compressed and more beaked form of the radial calicles is, however, the only tangible character for separating this form, even as a variety.

The secund condition, due to the partial suppression of the corallites on the under sides of some branches, is an accident of growth that may occur in any species. The smaller size of the branches is not even of varietal importance.

Brook not only considers *secunda* a good species, but he puts it in a different group,* far removed from *nobilis,* though he refers to my uniting these forms in 1864. Probably Brook had a different species, from Australia,† which he described under the name of *secunda;* but he also quotes Dana's description.

My conclusion in regard to this point, in 1864, was based on a *direct comparison of Dana's types* of both forms, with a fine series of *nobilis* in the Mus. of Comp. Zoölogy. Although I have studied larger collections since then, I have seen no reason to change my opinion.

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* Brook puts *secunda* in his 1st subgenus, *Eumadrepora,* on p. 30; *nobilis* in his 6th subgenus, *Tylopora,* on p. 135. This is mainly an account of the slight difference in the size of the axial corallites.

† Brook's Australian specimen is said to have the radial calicles rather distant, much compressed, thin-walled, tubo-nariform or dimidiate, 3–4.5^{mm} long, 1.2–1.6^{mm} broad; the walls striato-reticulate, not echinulate, unless at base. Most of these characters do not apply to Dana's *secunda,* especially the thin-walled, elongated, nariform corallites, nor would Dana's species go in the subgenus *Eumadrepora,* as defined.

Hence I believe it a distinct species with a superficial resemblance to *secunda* and would propose to call it *secundella,* sp. nov. The types are from Port Denison and Bandin Is., Australia (coll. Kent).

Even in 1864, I had devoted over three years to the continuous study of reef-corals, including all of Dana's types, so that I was then very familiar with all his species, and not more likely to err than now, in comparing types.

A. canalis Quelch, sp. (op. cit., p. 150, pl. ix, fig. 2), from the Philippines, is a very closely allied species, and perhaps will not prove to be distinct, when a series from that locality can be studied.

Brook refers the latter (with *nobilis*) to his subgenus *Tylopora*, on account of the large, thick-walled axial corallites. This character is as variable as others, and I think that Brook has given it too much importance in many cases, thus widely separating species that are closely allied, and perhaps, in some instances, widely separating forms that are mere varieties of a single species, as in the case of *secunda* and *nobilis*. To me this species seems to be more nearly allied to typical *Eumadrepora*.

Acropora pachycyathus Ver., sp. nov.

PLATE XXXVI. FIGURE 20. PLATE XXXVI C. FIGURE 5.
PLATE XXXVI F. FIGURE 6.

Coral probably cæspitose, perhaps corymbose. Branches divergent, stout, 20-25^{mm} in diameter, often irregularly proliferous; the terminal branchlets short, tapered, obtuse.

Axial corallites large and swollen, (4–5^{mm} in diameter), with thick, rounded, porous walls and a rather large, deep calicle, 2^{mm} in diameter. They are about 2-4^{mm} exsert.

Radial corallites large, thick, unequal in size, ascending, laterally sessile, very irregularly arranged, often aggregated into uneven and prominent clusters. The larger ones are mostly tubular, or conic-tubular, with stout, enlarged bases and thick, swollen, incurved summits; their small calicles open obliquely inward, so as not to be visible in a side view. But with these are some that are more regularly tubular, truncate at the blunt ends, with the calicle round and terminal; some of these may carry basal buds and eventually become axial corallites. They are from 3 to 5^{mm} long and 3 to 3.5^{mm} in diameter. They are mostly attached for the whole length of the inner side, but not appressed. The inner lip is usually very short or absent, but may be fairly well developed. The aperture is very small (0.6 to 1^{mm}) and often is almost concealed by the very thick, rounded outer lip, which usually curves inward very strongly. On the distal part of the branchlets they are more regular in form and arrangement, with the end truncate and the nearly round calicle opening upward.

Among the larger radial calicles are many that are smaller, shorter, conoidal or verruciform, with a very small terminal calicle, often less than 0.5^{mm} in diameter. No entirely immersed calicles occur on these branches.

Septa of the axial corallites 12, those of the 1st cycle well developed, the others narrower. In the radial corallites six are wide and six very narrow, but distinct.

Surface of walls and cœnenchyma everywhere rather coarsely and roughly echinulate; the granules on the distal corallites usually thorny or lacerate, not crowded, often in costal lines, but no costulæ are visible. The cœnenchyma is dense.

The type (No. 6141) is a single branch with four principal divisions and several small, distal, divergent branchlets.

Locality unknown (coll. Ward). Perhaps the rest of the specimen may be in the Field Columbian Museum.

This species is remarkable for the large, very thick-walled, closely adherent radial calicles, having the small apertures mostly concealed in a side view, by the very swollen, incurved outer lip.

It belongs to the group *Tylostoma*, in Brook's system, on account of the large and swollen axial corallites, but it does not have much resemblance to any other species of that group. Perhaps, in general appearance, it is more like *A. gonagra* than any other species.

Acropora prolixa Ver. See p. 217.

Madrepora prolixa Ver., Communications Essex Inst., Salem, vol. v, p. 22, 1866. Brook, op. cit., p. 187.

PLATE XXXVI. FIGURES 3, 3*a*. PLATE XXXVI A. FIGURES 3, 3*a*.
PLATE XXXVI F. FIGURE 14.

Mr. Brook (p. 187) referred this species doubtfully to his *M. longicyathus* (E. & H.), which he redescribed from the type.

Our species does not agree with his description, nor with an authentic fragment of the type of Edw. & Haime, sent to the Mus. of Comp. Zoölogy, by Prof. Milne-Edwards himself, and with which I had compared my type, in 1864, as then stated.*

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* Mr. Brook, in numerous instances, ignored the fact that I have had constant access to the types of Dana and others and that my determinations of species were made by comparison with types. Thus he often arrived at different and erroneous results. Had he kept this fact in mind, and given it due weight, he might have avoided several errors.

I will add the following details from one of my types:

The cœnenchyma is very finely and evenly echinulated, and almost without visible pores.

The radial corallites are mostly short, verruciform, but some are long, tubular, tapering from a thickened base; there are also many small immersed calicles. The radial calicles are all small, but they mostly have 12 septa, those of the second cycle being very narrow; those of the first cycle meet below, as seen in sections.

Wall of the axial calicles is thickened and rounded at the margin; the sides are without costæ. In sections the wall is thick and nearly solid, and the cœnenchyma is dense.

Ousima. No. 1686.

It is nearer *A. procumbens* (Br., p. 188, pl. xxviii) than to *longicyathus.* It also resembles, in a general way, *A. subglabra* (Br.), and *A. Rayneri* (Br.).

Acropora stellulata Ver., sp. nov.

PLATE XXXVI C. FIGURE 3. PLATE XXXVI F. FIGURE 10.

Coral arborescent, loosely and sparingly branched, with long slowly and regularly tapered, terete branches, which often diverge at an angle of 50° to 60°. The larger branches are 12 to 14^{mm} in diameter, or more; the undivided distal ones may be 70 to 100^{mm} long, and 10^{mm} in diameter, 70^{mm} from the end.

The axial corallites are of moderate size (2 to 2.5^{mm}), cylindrical, a little exsert, with somewhat thickened porous, strongly costulate walls, bearing small buds close to the end; the costulæ are regular, thin, and high.

The radial corallites are small, tubular, squarrose, short and standing nearly at right angles on the larger branches, but becoming longer and slightly ascending more distally. The larger ones on the distal half of the terminal branches are longer than broad (about 1^{mm} broad and 2^{mm} high), slightly or not at all compressed, not tapered, obliquely truncate, with the outer lip rounded, a little thickened, and slightly incurved; the inner lip thin. Their walls are porous, sometimes reticulate-porous, and strongly costulate, with thin, high costulæ. Between these are scattered many smaller, short, tubular corallites, mostly squarrose and with reticulate walls.

On the larger branches the corallites are of more uniform size and length, very squarrose, short tubular or sub-verruciform, not so high as broad (diameter about 1^{mm}), with the calicle terminal and about 0.5 broad. Wholly immersed corallites seldom appear, except a few on the under side of a single injured branch.

Six septa are well developed and form a regular star in all the calicles, the directives being wider. In many calicles six very narrow septa of the second cycle are visible.

The cœnenchyma is dense and rather closely covered with rather sharp rough granules, often united into linear or irregular groups, and also more or less covering the walls of the corallites on the larger branches.

Zanzibar, Mus. Yale Univ., type, No. 435. Received from Boston Soc. Nat. History, as a duplicate.

This species somewhat resembles *A. virgata* (D.), the type of which (No. 2001) I have compared with this. *A. virgata* has the larger radial corallites stouter, more ascending, more compressed, obliquely truncated, with a very short inner lip, and more strongly costulate and echinulate walls. The corallites of the larger branches are larger, less squarrose, more prominent. Its cœnenchyma is more strongly and more roughly spinulose.

Acropora tubigera (Horn). See p. 219.

Madrepora tubigera Horn, Proc. Acad. Nat. Sci., Philad., 1860, p. 435 (*non* Quelch, *nec* Brook).

PLATE XXXVI. FIGURES 1, 2–2*b*. PLATE XXXVI A. FIGURES 1, 2, 2*a*, 2*b*.
PLATE XXXVI F. FIGURE 8.

Horn's type, in the Mus. Phil. Acad. of Science, was carefully examined by me, many years ago, and described in my notes. Several fine specimens now in the Museum of Yale University and Mus. Comp. Zoölogy, from Singapore, were identified by me, at that time (1863), by direct comparison with the type.

It is a common Singapore species. Many specimens were brought from there about 1860 to 1863, by Capt. W. H. A. Putnam, during several voyages to that port. These are now in the Museum of Comp. Zoölogy; the Peabody Inst., Salem, Mass.; and the Yale Museum. Altogether I have seen about 20 specimens of it.

It forms somewhat irregular rounded or one-sided, much branched, convex clumps, up to 12 to 15 inches (300–375^{mm}) across, and 4 to 8 inches (100–200^{mm}) or more in height, with the proliferous terminal, upright branchlets rather slender, tapered, subacute, and usually terminated by a slender exsert axial corallite.

The texture of the coral is firm, dense, almost translucent, with few pores, and the surface of the cœnenchyma is generally vermiculated or irregularly pitted, sometimes costulate, and rough with more or less numerous spinulose granules.

The main branches spread out radially from the stout, one-sided or subcentral base, and branch dichotomously; the outer branches lie nearly in one plane, but usually do not coalesce to any considerable extent.

The under side is covered with short irregular branchlets, directed outwardly, and somewhat appressed, each having one or several long divergent, often crooked and tapered tubular axial corallites, up to 10 to 15^{mm} long, and 2 to 2.5^{mm} in diameter. Many of these tubular corallites stand separately, or in clusters of 2 or 3, without any radial corallites upon them; but most bear at least a few small, appressed radial corallites, and many terminate the small, irregular branchlets.

The immersed corallites of the under side are scattered, not very small, and have a conspicuous star.

The cœnenchyma beneath is very firm and dense, translucent, and with a strongly vermiculated, rough surface, in many places sharply granulated.

The ascending branches and branchlets of the upper side are much subdivided dichotomously, the divisions forming acute angles; those toward the margins are often very proliferous. The smaller simple branches are from 5 to 8^{mm} in diameter, and up to $20–25^{mm}$ long; usually evenly tapered and acute.

The axial corallites are slender (1.7 to 2^{mm} thick), cylindrical, and usually considerably exsert (up to $4–6^{mm}$, rarely 10^{mm}); the wall is moderately thick and very strong, though perforate, not swollen at the margin; its exterior is covered with regular and rather thin costulæ, between which there are rows of pores, in the grooves.

The radial corallites are rather large, especially on the larger branches, where they are nearly immersed; the distal radial calicles are about as large as the axial, or even larger. The distal radial corallites are short and rather openly tubular, with the summit very obliquely truncate, so that the inner lip is abortive, or nearly so; the outer lip is large, thin, often fenestrate, frequently a little narrowed and incurved at the tip, but often flaring somewhat. These corallites stand at angles of 30 to 45°, and are not appressed; they are about 2.75 to 3^{mm} long, and about 2.5^{mm} broad. The wall is thin, porous distally, and covered with regular, sharply defined costæ.

The calicles are all distinctly stellate; the radial ones have six strong primary septa, the directives widest, and usually six very narrow secondary ones. The axial corallites have six wide and subequal septa, usually with six very narrow ones of the second cycle.

On the proximal part of the branches some of the corallites are low, verruciform, and broad at base; others are immersed, not crowded, separated by coarsely and roughly echinulate and irregularly pitted, dense cœnenchyma; the calicles are large and their 12 septa are distinct and nearly equal.

Singapore (coll. Capt. Putnam). Nos. 1370, *a*, *b*, *c*, *d*, etc., No. 1483, fragment of type.

Acropora Bandensis Ver., nom. nov.

Madrepora tubigera Quelch, op. cit., p. 161. Brook, p. 79, (*non* Horn).

Probably the specimens described by Quelch and by Brook, from Banda, as *M. tubigera* were not of this species, for they say that it has a very porous cœnenchyma ("extremely porous," Brook), while in the type and in all our Singapore specimens it is remarkable for its density and hardness.

Brook also states that in the radial calicles the septa of the second cycle are "usually not noticeable," which is contrary to the condition in this species. The axial corallites are also said to be labellate or nariform. Therefore I propose to designate the Banda form as *A. Bandensis*, with the diagnosis as given by Brook.

Acropora tumida Verrill.

Madrepora tumida Verrill, Synopsis Polyps and Corals North Pacific Expl. Exp., Comm. Essex Inst., v, p. 21, 1866. Brook, op. cit., p. 163.

PLATE XXXVI. FIGURES 11–11*b*. PLATE XXXVI B. FIGURES 2, 2*a*, 2*b*.
PLATE XXXVI F. FIGURE 3.

This species is easily recognized by the evenness of the under surface of the partially coalesced branches, with very small immersed calicles, and by the short, swollen, thick-lipped corallites of the upper surface of the larger branches.

On the distal parts of the upright branchlets the tumid character of the radial corallites is not so marked, and they are directed more upward, or may become somewhat appressed, but they are thick at the base, and taper to the summit, with the end rather squarely truncated and the terminal calicle opening upward.

The walls are echinulo-costulate, or sharply echinulate, with the acute granules arranged in lines, and with very few pores. There are six well developed septa, and often four to six rudimentary ones.

The axial corallite is a little exsert, rather stout (2.5 to 3^{mm}) with thick walls and a small calicle with six subequal primary septa and six small secondary ones. The calicle is not larger than that of the radial corallites (about 1^{mm}).

A fragment of the original type, from near Hong Kong, is in the Yale Museum, No. 886. The rest is in the U. S. Nat. Mus.

A. glauca (Brook) is evidently closely related to this species, and very likely may be identical with it.

Acropora turbinata (Dana) Ver.

Madrepora surculosa, var. *turbinata* Dana, Zoöph., p. 446, pl. xxxii, fig. 5, 1846. Brook, op. cit., p. 200, 1893.

Madrepora turbinata Verrill, Bull. Mus. Comp. Zoöl., i, p. 42, 1864.

? *Madrepora armata* Brook, 1892; Brook, Catal., p. 100, pl. x, figs. A. B.

Plate XXXVI. Figure 6. Plate XXXVI A. Figure 6.
Plate XXXVI F. Figure 2.

The type of this form, which Dana considered a marked variety of *surculosa*, is in the Museum of Yale University, No. 2017.

It appears to be a species quite distinct from Dana's type of *M. surculosa*, from the Fiji Islands, fragments of which are also in the Yale Museum, No. 4181.

This coral forms a somewhat turbinate corymbose, nearly flat clump, consisting of stout, divergent, ascending primary branches, arising from an incrusting base and rarely coalescent. The exterior surfaces of the outer branches, from the base up, are covered with numerous, small, irregular, divergent, proliferous branches, not at all appressed, which give the under side a rough, ragged appearance. These mostly vary in length from 10 to 40^{mm}, the upper ones longer; the proliferous ones may bear branchlets $5-12^{mm}$ long and $4-6^{mm}$ in diameter, with slender exsert axial corallites, 1.5 to 3.5^{mm} long, and tubular, truncate, or labiate-tubular radial corallites, with the aperture either terminal or oblique. On the lower branches are numerous immersed corallites, about 1^{mm} in diameter, with rudimentary or abortive septa, as in *surculosa.*

The upper side is covered with rather slender, neatly tapered, acute, forked or proliferous upright branchlets, their divisions rising at an acute angle, and nearly parallel, as is well shown in Dana's general figure of this specimen. Some of them bear 6 to 10 divisions. The larger branchlets are 35 to 50^{mm} long, often 8 to 10^{mm} thick at base, when simple or nearly so; those toward the margins are compressed and stouter.

Axial corallites are rather small and slender, about 2^{mm} in diameter and $1-2^{mm}$ exsert; walls thin, reticulate-porous, strongly costulate; septa six, narrow, the directives usually a little wider.

Radial corallites small, prominent, regularly arranged, not crowded, strongly divergent, mostly at angles of 60° to 70°, openly tubular, with the aperture oblique and looking upward, not compressed, nor appressed, inner lip adnate or abortive; outer lip prominent, narrowed distally, concave, slightly or not at all incurved, very thin, fragile, reticulate-porous, regularly costulate, with thin costulæ. Calicles relatively large and open; septa nearly all abortive or rudimentary; sometimes the directives alone are visible and very narrow.

Below the middle of the branchlets and on the basal branches are numerous immersed calicles, 0·75 to 1^{mm} in diameter, with rudimentary or abortive septa.

Cœnenchyma very openly porous and pitted, or vermiculate, and sometimes lamellose at the surface.

Tahiti, J. D. Dana (coll. U. S. Expl. Exped.). Yale Mus., No. 2017.

This species is closely allied to *A. surculosa* (typical), and apparently to *A. corymbosa*, as restricted by Brook. Compared with a branch of Dana's type of *surculosa* from the Fiji Islands (Yale Mus., No. 4181), the latter has much more compact cœnenchyma, echinulate in series at the surface; the radial corallites are shorter with a broader, more dimidiate, and flatter outer lip, which is also firmer, much less porous, and more truncate, with more strongly costulate walls; the calicles are still more widely open, but have the same sort of rudimentary septa. The rather large, open, immersed calicles are also essentially the same, with rudimentary or abortive septa, but they are perhaps a little larger ($1–1.20^{mm}$).

Perhaps, with a large series, we might be obliged to reunite the two forms, but with the specimens that I have hitherto seen they seem to be as distinct as many of the recognized species of corymbose *Acroporæ*. Should we unite these species, it would probably be necessary to unite with them, also, *M. corymbosa* (Brook), *M. cytherea* Dana, *M. symmetrica* Brook, and others of the same group, in which the radial and immersed calicles are not stellate, but have only rudimentary septa. See below under *A. symmetrica*, p. 254, and *cytherella*, p. 253.

I cannot perceive any appreciable specific differences between this species and *A. armata* (Brook), as described and figured by Brook (see below, p. 252), and think that they should probably be united.

Acropora secale (Stud.) Ver. See p. 218.

Madrepora plantaginea Dana, Zoöph., p. 459, 1846 (*non* Lam.).
Madrepora secale Studer, Reise Corv. Gazelle, Monatsb. Kongl. Preuss. Akad. Wissens., Berlin, 1879, p. 530 (*non* Brook, p. 88, 1889).
Madrepora Ceylonica Ortmann + *M. remota* Ort. + *M. valida* Ort. + *M. secale* Ort., Zoöl. Jehr., 1889, iv, pp. 506, 510, pl. xiii, fig. 6; pl. xli, fig. 3.
M. Ceylonica Brook, op. cit., p. 162.

PLATE XXXVI. FIGURES 14, 14*a*. PLATE XXXVI B. FIGURES 5, 5*a*.

The large specimen from Ceylon, described by Dana, which is distinct from his Singapore specimens, is in the Yale Museum (coll. G. H. Apthorp). This is a crescent-shaped corymbose clump, attached by a large, one-sided pedicel. It is about 2 feet long and 1 foot broad, with the upper surface a little convex, the length of the upright branches decreasing from 75–85^{mm} in the middle to 25 to 40^{mm} near the border, while the under side is inclined upward. The main branches are completely coalesced, so that the under side is a nearly even, thick plate, without any projections and with scarcely any openings, except close to the margin, where the branches are reticulately joined; the immersed calicles of the under side are scattered, small, six-rayed.

The upright branches of the upper side are rather stout (mostly 10 to 15^{mm}), obtuse, somewhat angular, sparingly proliferous, except the marginal ones. They are rather close, mostly separated by intervals of 12 to 20^{mm}.

The axial corallites are rather thick and swollen, rounded, little exsert, with a small calicle and thick, porous walls; diameter, about 3–3.5^{mm}; calicle, about 1^{mm}. The calicle has 12 thin, narrow, subequal septa; wall closely and finely echino-granulate, in series.

The radial corallites are very unequal in size and form. The larger ones, which are mostly on the distal part of the branches, and within 25–35^{mm} of the tip, are large, tubular, a little tapered, with thick walls, rounded at tip, and with a small terminal calicle. Many of these have a few small, radial calicles on their basal portion, and are then like incipient branches. They are 3–6^{mm} exsert; diameter about 2.5–3^{mm}.

Between these, with some nearly or quite immersed calicles, are also many short (1–2.5^{mm}), thick, ascending or appressed, tubular corallites, with the outer lip thick, rounded, and often a little incurved, and the calicle oblique and slightly elliptical; the inner lip is short and thin, or often abortive. Wall densely and finely granulated, with sharp granules arranged in costal striæ.

Some of the radial corallites are longer (2–3^{mm}), with the outer surface convex, or boat-shaped, and the calicle opening obliquely inward. The radial corallites have six narrow primary septa, the directives rather wider when the calicle is elliptical; often 4 to 6 rudimentary septa of the second cycle are also visible.

Point Pedro, Ceylon, 1843 (Rev'd Geo. H. Apthorp), No. 3063. (See note, p. 210.)

This is the type-specimen on which Dana based his description of *M. plantaginea*. It, therefore, becomes also the type of *M. secale* Studer. Studer's *M. secale* was simply a new name for Dana's *plantaginea*. He gave no description. According to Brook (p. 88), Studer's specimens in the Berlin Museum include more than one species. He gave Singapore as the locality of his specimens. Therefore he probably had in mind an East Indian form, rather than the one from Ceylon. However that may be, Dana's type, from Ceylon, in the Yale Museum, was the one that he described.

The species described as *M. Ceylonica* by Ortmann, and by Brook, with the other related forms described by Ortmann, from Ceylon, appear to be varieties and different stages of growth of this species.

The specimens described by Brook, as *M. secale*, are probably a different species, and more like *A. appressa* (Dana).

In mode of growth this species resembles *A. leptocyathus* (Br.), and also *A. Guppyi* (Br.). It may prove to be only a variety of *A. effusa* (Dana), to which it is very closely related.

The specimens from Singapore, mentioned but not described by Dana, are quite distinct, with smaller upright branches; those of the lower side not forming a plate; axial corallites smaller; radial corallites short and swollen. One of these types is in the Yale Mus. (No. 2033). It is not *M. secale* of Brook. I have described it below under the name of *A. secaloides*.

Acropora secaloides Ver., sp. nov.

Madrepora plantaginea (*pars*) Dana, Zoöph., p. 459, (*non* Lam., t. Brook).
Madrepora secale (*pars*) auth., (*non* Studer).

PLATE XXXVI. FIGURES 15, 15*a*. PLATE XXXVI B. FIGURES 6, 6*a*.

One of the specimens that Dana named *M. plantaginea*, now in the Yale Museum, is quite distinct from the Ceylon specimen, on which his description was evidently based, and which has thus become the type of *A. secale* (Studer), see p. 244. The specimen referred to is from Singapore and apparently belongs to a species that has not yet received a distinctive name, hence I propose to call it *A. secaloides.*

It is a flat-topped corymbose clump, about 18x15 inches across (450x375^{mm}), and five inches (125^{mm}) thick. It arises from a stout, short, pedicellate base. The nearly horizontal primary branches coalesce into a nearly solid plate subcentrally, but farther out there are many irregular openings, and numerous flattened, obtuse, appressed branchlets, with only a few small, immersed calicles, the surface in general appearing rather smooth, as if covered with plaster of Paris.

The upper side is covered with nearly upright, moderately stout dichotomous branches, mostly 12–18^{mm} in diameter at base. Those of the central parts are 75 to 100^{mm} long. They may fork two or three times; most often they divide near the base into two or three ascending branches, and these again divide into 2 to 8 terminal branchlets, 25 to 50^{mm} long. Some of them may be proliferous near the tip; they are mostly 8 to 10^{mm} in diameter, little tapered, obtuse.

The axial corallites are of moderate size, 2.5–3.5^{mm}, usually about 3^{mm} in diameter, and 1–2^{mm} exsert, with the walls rather thick, compact, and finely, evenly echinulate-granulate, not at all costulate; calicle small, with 12 unequal septa.

The larger radial corallites are short, divergent, with very thick, prominent, rounded outer lip, not appressed; inner lip usually wholly adnate; calicles, rather small, .07–.08^{mm}, conspicuously stellate, opening upward, little visible in a side view; primary septa well developed, secondaries narrower, but very distinct. Walls thick, compact, very evenly and finely echinulate-granulate, like the cœnenchyma.

Between the larger radial corallites there are many smaller ones, often verruciform, with short lips, and some wholly immersed. On the proximal third of the branches most of the calicles are immersed, but stellate with 12 septa. Cœnenchyma rather compact, everywhere evenly echinulate-granulate.

Singapore, U. S. Expl. Exped., No. 2033, Yale Mus.

Probably this species has been included under *A. secale* by several writers. Indeed, it is quite probable that Studer himself so included it, for he refers to specimens of the latter from Singapore, but he did not describe them. It does not appear to agree with *A. secale* (Brook), *non* Stud., which has more appressed corallites, but it may be that it varies in this respect.

In general appearance this has some resemblance to *A. calamaria* (Br.), but the primary branches of the latter do not coalesce into a basal disk, at least in the type, and its branchlets are more obtuse, shorter and thicker, and the corallites do not agree very closely.

Acropora fraterna Ver., sp. nov.

PLATE XXXVI. FIGURE 18. PLATE XXXVI B. FIGURE 9.

One of the specimens in the Yale Museum labelled as *M. paxilligera* by Dana, differs specifically from another type-specimen, which agrees well with his description and figure.

This coral forms a large, flat-topped, turbinate clump, covered above with stout, conoidal, subacute branches; below, it arises from a stout, compact pedicel, 6 to 7 inches (150 to 175^{mm}) in diameter, rapidly widening upward. It is formed by large, obliquely ascending, primary branches, which are almost completely coalesced into a thick mass, with only a few submarginal openings, and covered beneath with numerous, rather large (1.10 to 1.30^{mm}), stellate, immersed calicles, but without any projecting branchlets nor prominent corallites.

The upper marginal branches are stout, very obliquely divergent, and digitate, more or less coalesced proximally. The upright branches of the central portions are not crowded, elongate-conical, 35 to 50^{mm} long, 15 to 25^{mm} in diameter at base, regularly tapered, subacute.

The axial corallites are rather large, mostly 3 to 3.5^{mm} in diameter; 1 to 2^{mm} exsert, with moderately thick, very porous walls, strongly costulated externally; septa usually 12, narrow.

The radial corallites are very unequal; the larger distal ones are 2–3^{mm} exsert, about 1.5–2^{mm} in diameter, tubular, scarcely compressed, obliquely truncated or labellate, with a dimidiate lower lip, which is not thickened nor incurved, or but slightly so; inner lip usually pretty well developed, free, but thin, often entirely adnate; outer walls strongly costulate, with rows of large pores between the costulæ. Septa usually 12, the six primaries rather narrow; the others almost rudimentary.

Between the larger radial corallites there are many crowded smaller ones, 0.5 to 1.25^{mm} in diameter, short-tubular, rather exsert, with thin, costulate walls, and an open terminal aperture, which may be more or less oblique. The larger corallites stand out rather prominently and are sometimes squarrose, but in other cases form an angle of about 68°–75°. The cœnenchyma is loosely porous, or reticulate-porous. Immersed calicles become numerous on and between the bases of the branches.

Tahiti, U. S. Expl. Expd. No. 2032.

The *A. gemmifera* (Br.) grows in much the same form as this species, so far as the upper side is concerned, but it does not seem to form a solid basal disk, and its short, conical, lateral branchlets do not occur in this species. The corallites are quite different in form.

Acropora Wardii Ver., sp. nov.

PLATE XXXVI. FIGURE 13. PLATE XXXVI B. FIGURE 4. PLATE XXXVI F. FIGURE 4.

Coral a flat-topped, corymbose clump, arising from a large, thick, short base, 150 to 250^{mm} broad. The larger specimens are 18 to 20 inches across (450 to 500^{mm}), and 100 to 125^{mm} high. The lower side of the disk is composed of firmly coalesced, nearly horizontal, primary branches, united into a large, thick, continuous plate, except near the margin, where it becomes lobate; most of the under side is covered with epitheca, to within 50 to 70^{mm} of the margin, where the cœnenchyma is at first compact, nearly even, and finely granulated, but nearer to the margin it bears slightly elevated corallites, becoming more prominent close to the margin.

The upper surface is evenly and rather closely covered with short, stout, often crowded and subangular, bluntly tapered, upright branches, the submarginal ones becoming oblique, and those at the edge short, nearly horizontal, often coalesced. The central ones are mostly 35 to 40^{mm} high, and 15 to 20^{mm} thick at base; they are mostly separated by intervals of 6 to 10^{mm}. The cœnenchyma between their bases is covered with immersed calicles.

The axial corallites are of moderate size, often not much larger than the radial ones, diameter 2.5 to 3^{mm}, 0.5 to 1^{mm} exsert, with a porous thickened wall, strongly costulate externally; calicle small, about 0.75^{mm}, with 12 narrow septa.

Radial corallites short, mostly 1.5 to 2^{mm}, numerous, much crowded, with a dimidiate or auricular lower lip, which is only a little thickened and is strongly costulate externally, with small pores between the costulæ. The larger distal corallites are about 1.5 to 1.7^{mm} thick, often short, dimidiate-tubular, scarcely, if at all, compressed, with the upper side cut away obliquely, so that the aperture is wide-open, and looks upward and outward, and is visible in a side view. The inner lip is often free for a short distance, but usually wholly adnate. Lower down the corallites rapidly become shorter and the lower lip becomes a thin crescent-shaped margin, and at the base many calicles are wholly immersed.

The septa are all narrow, except the directives; the six secondaries are often present, but very narrow; in other cases abortive. Cœnenchyma openly reticulate-porous.

East Indies or Polynesia? (coll. H. A. Ward), Yale Museum, No. 6151. Also in Field Columbian Museum.

In form of coral and mode of growth, this species resembles *A. Guppyi* (Brook), as figured by Brook, but the latter has stouter branches with much larger axial corallites, and the walls of the latter are not costulate.

It has some resemblance to *A. conigera* (D), but the branches are larger and more obtuse; the calicles are shorter, more crowded, and less labrate ; the walls are more regularly costulate and fenestrate ; and the cœnenchyma is finer and not so rough.

Several specimens were in the Ward collection several years ago (Nos. 6118, 6120, 6151), from which the above description was made. That collection was afterwards sold to the Field Columbian Museum. A few fragments of No. 6151 are in the Museum of Yale University.

Acropora polymorpha (Brook) Ver.

Madrepora polymorpha Brook, Ann. and Mag. Nat. Hist., viii, p. 466, 1891. Catal. Mad. Brit. Mus., p. 169, 1893.

Madrepora abrotanoides Dana, Zoöph., p. 477, pl. xli, fig. 1, 1846 (*non* Lam.).

Several branches from specimens labeled as *M. abrotanoides* by Dana are in the Yale Mus. (No. 4202). A careful study of these shows that they belong to two distinct species.

That which is most fully represented is the species figured by Dana. One of our specimens appears to be the figured branch. It agrees with Brooks' description of his *M. polymorpha*.

It has unequal, compressed-nariform, thick-walled, prominent, divergent radial corallites, with the small, elliptical, stellate calicles looking obliquely upward; outer lip thick, rounded, and prominent; inner lip usually free for some distance. External surface of wall is densely and finely echinulo-granulate, not costulate.

Between the larger corallites are many small tubular or verruciform corallites with a small terminal or subterminal calicle. The cœnenchyma is compact and finely granulated.

Acropora neglecta Ver., sp. nov.

Plate XXXVI. Figure 21. Plate XXXVI E. Figure 7.
Plate XXXVI F. Figure 5.

The other species, mixed with the last, which I have been unable to identify, is represented only by a single terminal branch, 13^{mm} in diameter, with a few short, divaricate branchlets, three arising at one point in one case. It was evidently arborescently branched.

Axial corallites about 2.5^{mm} in diameter, and 3^{mm} exsert, with strongly costulate wall, and 12 very distinct subequal septa, the directives wider.

Radial corallites are tapered, tubular, or conoidal, ascending, not compressed, obliquely truncate, with the round stellate calicle looking upward and somewhat outward; outer lip a little prominent, not much thickened, narrowed, and incurved; inner lip thin, usually free for a short distance, but often entirely adnate. Outer wall strongly costulate, with the costulæ rather coarsely echinulate, and with small pores in rows between the costulæ.

Septa 12, unequal, but all narrow, the directives a little wider. There are but few small calicles between the larger, and none immersed.

The larger corallites are openly arranged, much fewer than in *polymorpha*, and very different in the conoidal form and strongly costulate exterior. The cœnenchyma is irregularly and strongly pitted and roughly echinulate, in series. This is a true *Eumadrepora* (Brook).

Probably this specimen was from Singapore, or that region. U. S. Expl. Exped., 1846. No. 6126, Yale Mus.

Acropora pumila Ver.

Madrepora pumila Verrill, Comm. Essex Inst., v; p. 23, 1866. Brook, p. 166.

Plate XXXVI. Figure 5. Plate XXXVI A. Figure 5.
Plate XXXVI D. Figure 9.

In addition to the original description, which is pretty complete, the following points are noted. The calicles, both axial and radial, are unusually small, mostly not over 0.5^{mm}, and some on the lower branchlets are immersed and still smaller, but the immersed calicles are scattered and inconspicuous. On the lower branchlets the axial corallites are often so thickened that the calicle becomes very small, or almost obsolete. Some of the calicles, both radial and axial, have 12 septa; the primaries are all rather narrow and subequal; the secondaries very narrow.

Many of the lateral corallites are verruciform or low conoidal, with a wide thick base.

The cœnenchyma and walls are nearly uniformly covered with close, rough, not very minute granules.

Bonin Islands, U. S. North Pacific Expl. Exp. Yale Mus., No. 1687.

Acropora striata Ver.

Madrepora striata Ver., Comm. Essex Inst., v, p. 24, 1866. Brook, p. 178.

PLATE XXXVI. FIGURES 4, *4a*. PLATE XXXVI A. FIGURES 4, *4a*.
PLATE XXXVI F. FIGURE 7.

This species is notable on account of the large size of the calicles and the thin, flaring lips of the tubular corallites, which have regularly costulate, thin walls.

The axial and gemmiferous radial corallites are either exsert-tubular or somewhat trumpet-shaped, many being distinctly widened distally and 2–2.5^{mm} in diameter, with the wide, round calicle about 1.5^{mm}; they are often 4–5^{mm} long, with thin, flaring, porous edges.

The normal radial corallites are mostly openly tubular, about 3^{mm} long, with the summit obliquely truncated and the inner lip nearly or quite adnate, but not at all appressed nor compressed. The outer lip is thin, but firm, usually somewhat excurved, so that the calicle is widely open (1.5^{mm}) and looks outward and upward. The corallites mostly stand out pretty strongly, at angles of 50° to 70°.

The septa are unusually well developed in the radial corallites; the six primaries nearly or quite meet in the center, rather deep down in the calicles; the directives generally unite: the secondaries are narrow, but usually distinct.

The cœnenchyma is firm, somewhat translucent, but with the surface irregularly pitted and sharply echinulo-granulate.

It is a handsome, shrubby or arborescently branched species, not very closely allied to any other that I have seen, except *A. tubigera*, with which it has several points in common.

Ousima, U. S. N. Pacific Expl. Exped. Yale Mus., No. 1688.

Acropora urceolifera Ver., sp. nov.

Madrepora corymbosa Dana, Zoöph., p. 456, 1846 (*non* Lam.).

PLATE XXXVI D. FIGURE 3. PLATE XXXVI E. FIGURE 6.
PLATE XXXVI F. FIGURE 13.

It is remarkable that no recent writer seems to have had in hand the species described by Dana as *corymbosa*. A part of the original type is in the Yale Mus., No. 4187, labelled in Dana's handwriting.

It agrees well with his description. I have never met with any other example of the same species. It is easily recognizable on account of its peculiar, more or less urceolate radial corallites, which have thin walls, often constricted below the aperture.

It is very unlike the type of *corymbosa* described by Brook, which is nearly allied to *A. spicifera*, *A. cytherea*, and *A. surculosa*. Dana states that this species is cæspitose, but our fragment is insufficient to determine the form of growth. It is a single nearly straight branch, 50^{mm} long and 10 in diameter, with four divergent branchlets arising from one side, as if it were a proliferous submarginal branch from the upper side of a corymbose or cæspitose clump. The branches are tapered, obtuse.

Axial corallites are rather large and prominent, 3.5^{mm} in diameter and 2–3^{mm} exsert, with thick, porous, closely echinulate walls and funnel-shaped calicles, about 1.5^{mm} in diameter.

Radial corallites are thin-walled, and unequal in size and form. The larger ones are rather large and prominent, 3^{mm} long and 2–2.5 in diameter, standing mostly at angles of 45° to 60°, and sometimes in vertical rows. They are tubular, mostly somewhat swollen in the middle and rather suddenly narrowed or constricted just below the orifice, so as to give them an urceolate form; but many are scarcely, if at all, swollen, and have the outer lip incurved, and often slightly beaked, or with the edge lacerate.

The aperture is round, oblique, and looks upward and inward. The corallites are not at all appressed, and the inner lip is usually free for some distance. The walls are thin, but firm, not costulate, but thickly covered with rather strong, sharp, rough spinules, sometimes arranged in costal rows.

Between the larger corallites are many that are small, short-tubular, or verruciform, with the calicle terminal and the lips lacerate.

Septa distinct, but all narrow; the secondaries often rudimentary or abortive.

The cœnenchyma is firm, irregularly pitted, thickly covered with sharp spinules.

Precise locality unknown, E. Indies or Indian Ocean (Dana).

This species differs from all others known to me in the swollen and urceolate form of the radial corallites, with their spinulose walls. *A. neglecta* Ver. approaches it, in this respect, more nearly than any other species.

Acropora armata Ver.

Madrepora armata Brook, op. cit., Ann. and Mag. N. Hist., x, p. 452, 1892. Catal. Mad., p. 100, pl. x, figs. A, B, 1893 (?=*A. turbinata* Ver.).

Mr. Brook considered the coral figured by Dana as variety of his *spicifera* (p. 443, pl. 31, figs. 6–6*c*, pl. 33, figs. 4–4*b*) identical with his *armata*.

This does not seem to be the case.

The type of Dana's variety is in the Museum of Yale Univ., No. 2007. It differs in the details of the corallites and cœnenchyma, though it grows in similar form. It also resembles *A. turbinata* in its mode of growth, but it has much smaller calicles than the latter, the walls and cœnenchyma are much less porous, and the outer lip is narrower and more ascending.

A. turbinata agrees, therefore, very closely with *A. armata* and is probably identical with it, for the latter has the same spreading radial corallites and very porous and fragile lower lip as *turbinata*. But Dana's variety has an ascending or almost appressed outer lip, which is compact and strong, though thin, and the corallites and calicles are decidedly smaller. I propose to call the latter *A. cytherella*.

Acropora cytherella Ver., sp. nov.

Madrepora spicifera (var.) Dana, Zoöph., p. 443, pl. xxxi, figs. 6–6*c*, pl. xxxiii, figs. 4–4*b*.

PLATE XXXVI. FIGURE 7. PLATE XXXVI A. FIGURE 7.
PLATE XXXVI F. FIGURE 1.

The coral is vase-shape or salver form, from a stout pedicel, and the under surface of the coalesced branches is covered with divergent calicles and dwarfed branchlets in the type, as figured by Dana.

The branches of the upper side are slender and very proliferous distally, mostly 25 to 35^{mm} long. The axial corallites are about 2^{mm} in diameter and 2–3^{mm} exsert, cylindrical, with firm, finely and regularly costulate walls.

Radial corallites dimidiate-tubular, elongate, 2–3^{mm}, strongly ascending, not truly appressed; outer lip long, thin, but not fragile, half-round, with the aperture very oblique; inner lip thin, often free to some extent, but mostly adnate; wall finely and regularly costulate with a few very small pores in the grooves. Cœnenchyma irregularly and roughly pitted, and spinulose, rather firm.

Calicles small, 0.5 to 0.8^{mm}. Septa distinct, but narrow, in the axial corallites, usually 6, sometimes 12; all nearly abortive in the radial calicles.

Fiji Is., U. S. Expl. Exped., No. 2007.

This is not identical with *A. armata*, as supposed by Brook. See remarks under the latter, above.

It is closely allied to *A. surculosa* and *A. cytherea*, but has much smaller corallites and calicles than either of those species, and differs in other ways.

In the very numerous, small and slender upright branchlets this species resembles *A. arcuata* (Br.), to which it appears to be nearly allied.

Acropora symmetrica (Brook) Ver.

Madrepora symmetrica Brook, p. 94, pl. xv, 1893.
?=*Madrepora corymbosa* (*pars*, Lam.). Restricted by Brook, p. 97.
?=*Madrepora surculosa* Dana, var., p. 445.

PLATE XXXVI. FIGURE 8. PLATE XXXVI A. FIGURE 8.

A large specimen from Zanzibar, in the Yale Mus., seems to agree closely with Brook's type, as described and figured, but is rather more proliferous beneath and has somewhat longer upright superior branchlets.

Our specimen is a broad, flat-topped corymbose coral, with a stout pedicel, nearer to one side. It measures about 16x18 inches, or 400x450^{mm}, across the top.

The free part of the disk, beneath, on the widest side, is 12 inches, or 300^{mm}. Diameter of pedicel, 3.5 inches, or 88^{mm}. The disk is composed of intricately coalesced branches, with numerous rounded openings, 12–30^{mm} or more in diameter. The under side is covered with an abundance of short, irregular branchlets, more or less appressed toward the margins, giving it a rough appearance. They spread nearly at right angles on and near the pedicel, and are covered like the cœnenchyma with large immersed calicles and others that are short and appressed.

The upper side is thickly covered with rather slender, acute, furcate and proliferous branches, upright in the middle and curved outward and upward toward the margins, so as to rise to about one general level. Many of them are 70 to 80^{mm} long, with the branchlets mostly 25 to 50^{mm} long, and mostly about 6 to 8^{mm} in diameter, but often with shorter distal ones, 5–10^{mm} long. They are mostly separated by spaces of 10 to 20^{mm} at tips.

The axial corallites are slender, about 1.3 to 1.5^{mm} in diameter, and 1 to 3^{mm} exsert. They have a rather thin but firm, costulate wall; septa usually only six, and all narrow.

The normal distal radial corallites are ascending and loosely imbricated distally, round, dimidiate-tubular, with an elongated, straight, slightly incurved, or a little flaring, hollow lower lip, which is sometimes very slightly thickened ; its edge is obtuse and denticulate ; wall strongly costulate with rows of pores in the grooves ; inner lip thin, mostly adnate.

The calicles are rather large, about 1^{mm} in diameter, round or nearly so, and look upward and slightly outward.

Lower down, the lower lip rapidly becomes shorter and mostly disappears on the bases of the branchlets and on the larger branches, where open immersed calicles are numerous and conspicuous ; they are usually at least 1^{mm} in diameter.

Septa in all the radial calicles are nearly all abortive or rudimentary ; often two very narrow directives are alone present ; in other cases 4 or more additional rudimentary ones can be seen with a lens, especially in the immersed calicles.

Cœnenchyma is roughly and irregularly reticulately pitted and vermiculate, and with rough echinulations in series.

Zanzibar. No. 79. Exchange, from Peabody Inst., Salem. Branches of other specimens, with longer branchlets, from Mozambique, are in the collection.

Although this specimen appears to be identical with *A. symmetrica*, I have described it pretty fully, to show its probable identity with *A. surculosa* Dana.

I have compared it directly with Dana's original types of the latter in the Yale Museum, and can find no tangible differences between it and No. 4178, from Tahiti, and others, in the details of the corallites. The walls, lips, calicles, and septa are identical, except that the calicles of the Tahiti specimen may be in part a trifle smaller, and the branchlets that I have at hand are also a little smaller, but they do not differ so much as do those from contiguous parts of our specimen.

The somewhat greater length of the upright branches of the upper side and the abundance of imperfect proliferous branchlets on the lower side, are the only noticeable differences.

These are both very variable characters in corymbose corals of this group. Therefore I believe that the two forms should be united.

The above description may be considered as essentially a description of *A. surculosa*, as to the details of the corallites, calicles, and cœnenchyma.

It is certain that several of the forms admitted as "species" by Brook in this group are very closely related, and perhaps are mere local or growth-varieties of one species. The *A. corymbosa* (Lam.) as restricted and described by Brook, from the type, with its several varieties, belongs to this series, and bears the earliest name.

It seems to me probable that a careful study of a good series of specimens would compel us to unite *A. surculosa*, *A. turbinata*, *A. armata*, and *A. symmetrica* as varieties of *A. corymbosa*. It may also become necessary to unite with these *A. cytherea* and *A. cytherella*, as somewhat more marked varieties.

All these forms are essentially alike in form and mode of growth; in the structure of the corallites; and especially in the rudimentary condition of the septa. All have an abundance of rather large, open, immersed calicles on the larger branches.

Brook puts all these forms in section C of his subgenus *Polystachys*, but he puts *surculosa* in subsection *c*, and the rest in subsection *a*. I can see no grounds whatever for this distinction; moreover these forms do not, as a rule, conform with the characters given by him for his section C.

Some of the forms referred to *corymbosa* by Klunzinger (as his fig. 1, pl. iv, and fig. 2, pl. 1) seem to me very different from the *corymbosa* of Brook (after Lam.), although admitted by Brook, without question, in his synonymy.

As photographed by Klz., the radial corallites are speading and have a decidedly thickened outer lip, while Brook states the outer lip is "half-tubular or labellate" and "very fragile." Moreover the Red Sea form is represented as having much larger and stouter branches than the type.

This stout-branched Red Sea form, with thickened walls and stout lip to the corallites, seems to me a distinct species. I have examined several specimens of this sort, from the Red Sea, but have not seen a good series.

For the same reason, I have not thought it desirable, at this time, to formally unite all the forms, mentioned above, as varieties under *A. corymbosa*, for of some of them I have seen only single examples. Far better series are doubtless to be seen in the British Museum and probably, also, in the large collections of South Pacific corals recently added to the Mus. Comp. Zoölogy by Mr. A. Agassiz, but which I have not yet seen.

The *M. corymbosa* of Dana is a very different species. See *A. urceolifera*, p. 251.

Acropora millepora (Ehr.), and var. **squamosa** (Brook).

Madrepora millepora Brook, op. cit., p. 116, 1893. Dana, Zoöph., p. 446, pl. xxxiii, fig. 2, 1846.
Madrepora squamosa Brook, Ann. and Mag. N. H., x, p. 463, 1892; op. cit., p. 120, pl. xx, fig. B.

Brook has redescribed the type of Ehrenberg. He considered it distinct from the *M. millepora* of Dana, and described, as a new species (*A. squamosa*), the form that he identified with Dana's. To me, the differences mentioned seem trivial and not of specific value.

In either case, Dana apparently had both forms in view when he described his *M. millepora*. Portions of the types of his species of that name are in the Yale Museum, and also a good series of specimens of this species received from Singapore (coll. Capt. W. H. A. Putnam).

Several of the latter agree with the *A. squamosa* (Brook), but I cannot distinguish them as more than a slightly marked variety of *A. millepora*.

I think it probable, also, that *A. subulata* is only a longer-branched variety of *A. convexa*.

Acropora nasuta (Dana) Ver.

Madrepora nasuta Dana, Zoöph., p. 453, pl. xxxiv, fig. 2, 1846.
Madrepora nasuta and var. *crassilabia* Brook, op. cit., pp. 73, 74, 1893.

One of Dana's types is in the Museum of Yale University (No. 2026, and 4187, branches), as well as other similar specimens from different sources. It is the form described as var. *crassilabia* by Brook.

This type forms a rounded, convex, thick clump of divergent branches and branchlets, which show no tendency to coalesce or form a basal disk. The marginal branches are divergent, stout, and shorter than the others. In these respects it agrees with Dana's figure, but not with the larger specimen that he described.

The radial corallites are prominent, compressed, and truly nariform, as well described by Dana. The lower lip is elongated, narrowed, incurved, and decidedly thickened, as in the type of *crassilabia*. The edge of the lip is usually lacerate and rough. The walls are finely echino-costulate. The calicles are elliptical, with 12 septa, more conspicuous in the immersed calicles of the bases of the branches. Tahiti (Dana).

Acropora cucullata Ver., sp. nov.

PLATE XXXVI D. FIGURES 8, 8*a*. PLATE XXXVI E. FIGURE 1.

The coral forms a broad, flat-topped, corymbose clump, covered with rather long, moderately stout, upright, dichotomous, and more or less proliferous branches, those toward the margin arching outward at the base; on the under side usually with numerous divergent, abortive branchlets.

The upright branches are mostly 8 to 10^{mm} in diameter, and 35 to 50^{mm} or more long, round, or subangular when crowded, little tapered to near the ends, which are rapidly narrowed and a little obtuse.

Axial corallites moderately thick, about 2.5^{mm}, scarcely exsert; wall thick, porous, rounded, costulate, with many pores between the costulæ.

Radial corallites unequal; the larger normal ones are large, prominent, about $2.5–3^{mm}$ long, $2–2.5^{mm}$ broad, divergent at angles of 45°–70°, a little compressed, arched-nariform or cucullate, with the wall thickened and convex on the middle of the outer side, and the thick, obtuse outer lip arched and incurved, so as to produce a hooded form on many of the larger corallites. The edge of the lip is thin and lacerate. Between these are many smaller, short, open tubular or subnariform corallites, with thin lacerate lips, and also many that are immersed, with wide, deep calicles, $1–1.10^{mm}$ in diameter.

The septa are all narrow, and part of them are often rudimentary. In the larger radial corallites the directives are more distinct, but ten other subequal narrow septa are usually visible. In the immersed calicles they are mostly obsolete, or nearly so, except the directives, which may meet in the middle, in some cases. But many calicles occur in which all six primary septa are well developed, deep down in the calicle; others occur with 12 distinct, equal septa, at the edge.

Many of the upright branches also bear more or less numerous gemmiferous corallites, rather longer and larger than the normal radial ones, about 4^{mm} long and 2.5^{mm} broad. These are also at first cucullate with a thick, arched outer lip, and bear 1–4 small, arched corallites; some may later become more evenly tubular, like the axial corallites. All the corallites have finely costulate walls.

Immersed corallites are abundant on the primary branches; less numerous beneath. The cœnenchyma is porous, with numerous, elongated pits, and roughly echinulate.

Indo-Pacific (coll. Ward), No. 6130, Yale Museum. Also Field Columbian Museum. This species is somewhat allied to *A. nasuta*, but is different, not only in growth, but the corallites are more arched and incurved; the walls are more finely costulate and not so rough; the septa are less developed; and the texture more porous.

In mode of growth and form of branches it resembles *A. Kentii* (Br.) and *A. obscura* (Br.), but neither of those species have the peculiar form and structure of radial corallites seen in this.

Acropora paniculata Ver., sp. nov.

PLATE XXXVI D. FIGURES 7, 10, 10*a*. PLATE XXXVI E. FIGURE 5.

Coral much branched, forming small dense clumps, 150 to 200^{mm} high and broad, in which the principal branches, which are 12 to 15^{mm} in diameter at base, are repeatedly forked; branches proliferous on all sides, with slender ascending or somewhat excurved branchlets of different lengths, thus producing panicle-like groups of branchlets. The terminal branchlets may be 20 to 40^{mm} long, and 3 to 5^{mm} in diameter, tapered, acute, often bearing 1–3 long, exsert, tubular corallites, besides the axial one.

The axial corallite is slender and exsert, about 1.5^{mm} wide and 3 to 5^{mm} long, with a thin strongly costulate wall and a regular 12-rayed calicle.

The exsert, tubular, lateral gemmiferous calicles may be 6 to 8^{mm} long and 1.5^{mm} in diameter, with 1–3 small basal buds, and costulate wall; the calicle is round and terminal, as in the axial one, with 12 distinct septa; some of them are slightly larger or clavate distally.

The normal radial corallites are prominent, ascending, elongate-tubular, obliquely truncate, nearly as large as the axial ones, with round calicles; the more distal ones usually have the inner lip free for some distance and the end only slightly obliquely truncated, with thin, porous, but firm, costulate walls; those lower down have the inner lip adnate, or nearly so, and the aperture more oblique, with the lower lip a little prolonged, and sometimes a little thickened; some of them are slightly wider distally; all are strongly costulate.

On the bases of the branches they become short-tubular, or verruciform, and many are entirely immersed; these have calicles about 1^{mm} in diameter, with 12 narrow septa.

The cœnenchyma is firm, sparingly porous, irregularly pitted, sparsely covered with minute, sharp granules.

Fiji Islands (?) or Tahiti, Yale Museum (coll. Mrs. Mills), No. 3810.

This species has some resemblance to *A. tubigera*, but the form of the radial corallites is different and it lacks the numerous long, tubular, clustered, exsert corallites of the outer branches. The texture of the cœnenchyma is also different and less compact. The mode of branching is similar, and both have similar costulate walls and stellate calicles.

It also has some resemblance to *A. delicatula* (Br., pl. xxviii), but the latter is more suffruticose, with more profuse and more slender branchlets. The tubular corallites are longer and more numerous.

Acropora acuminata Ver.

Madrepora acuminata Ver., Bull. Mus. Comp. Zoöl., i, p. 40, 1864. Brook, op. cit, p. 38, 1893.

PLATE XXXVI D. FIGURE 5. PLATE XXXVI E. FIGURE 2.
PLATE XXXVI F. FIGURE 11.

This arborescent species branches much like some specimens of *A. muricata*, var. *cervicornis*. The long branches are apt to arise several near together and diverge widely, tapering very gradually. The larger branches are about 20 to 30^{mm} in diameter and 150 to 250^{mm} long.

The axial corallites are of moderate size, not swollen. The normal radial corallites are mostly of one form but unequal in size, widely divergent, mostly standing at angles of 60° to 80°, sometimes 90°. They are mostly rather large, 2 to 2.2^{mm} in diameter, and about the same in length, or 2 to 2.75^{mm}, with rather open, nearly round calicles, 1 to 1.2^{mm} in diameter, looking outward and upward.

The corallites are regularly short tubular, with the end very obliquely truncated or dimidiate and often slightly enlarged, rarely a little compressed. Outer lip a little thickened, often slightly incurved, obtusely rounded; inner lip thin, the free part not half as long as the outer lip. Wall firm, strongly costulate, with small pores in the grooves. Between the large corallites there are many small ones of similar form, but with the calicle less oblique and lips thinner.

On the large branches there are also, in some cases, many longer, spreading, gemmiferous, tubular corallites, with the calicle more nearly or quite terminal. The larger of these are nearly like the true axial corallites in form, about 3–4^{mm} long, and 2.25–2.75^{mm} in diameter; they mostly bear only 1–4 very small basal calicles. The walls are roughly and strongly costulate.

Septa very narrow in all the calicles: usually there are six narrow primaries, the directives a trifle wider; sometimes a few rudimentary secondaries are also present.

Cœnenchyma irregularly and roughly pitted, or vermiculate and echinulate.

Kingsmills Islands (coll. A. Garrett). Received from the Mus. Comp. Zoöl. No. 1007.

The above description is from one of the original types. In general appearance and mode of growth it considerably resembles *A. grandis* (Brook) and *A. intermedia* (Brook), as figured by Brook (op. cit., pl. i), but the corallites of both these are quite different, being small and with a more nearly terminal aperture than in our species.

Acropora Ehrenbergii (E. and Haime) var. **scandens** ?

?*Madrepora Ehrenbergii* Edw. and Haime, Hist. Corall., iii, p. 143.
?*Madrepora scandens* Klunz., Corall. Rothen Meeres, ii, p. 26, pl. ii, fig. 6, pl. iv, fig. 3, pl. ix, fig. 21. Brook, p. 48.

PLATE XXXVI D. FIGURE 6. PLATE XXXVI E. FIGURE 3.

A large and fine specimen, apparently of this species, but not agreeing very closely with the descriptions, was studied by me. It was formerly in the Ward collection.

It consists of a very large, one-sided, irregularly reticulated corallum, about three feet (900^{mm}) broad and two feet (600^{mm}) high. It arises obliquely from a stout pedicel. The main branches, which are 25–62^{mm} in diameter, diverge and rapidly subdivide into smaller branches, which are very proliferous, the branches being arranged somewhat in one plane. The distal small branches rise up very obliquely and have tapering tips; many small, short, proliferous branches, with similar tips are scattered over the upper side of the frond. On the under side the branches coalesce into an open reticulum, with large, unequal and very irregular meshes, 75 to 100^{mm} long and 25 to 38^{mm} wide.

The larger basal branches bear divaricate, conical branchlets, 10 to 20^{mm} long, 5 to 10^{mm} thick, and others 50^{mm} or more long, and 12 to 15^{mm} thick, which are proliferous and bear smaller divaricate, conical branchlets, 5 to 12^{mm} long. These small, conical branchlets have a large, conical axial corallite, often 5 to 12^{mm} long and 3 to 5^{mm} in diameter at base. They are covered with round, short-tubular, obliquely truncate corallites standing at about 45°, with a round, open calicle; outer lip thickened, obtuse.

Septa 12, all narrow, the directives a little wider. On the larger branches are scattered rather large, open calicles, about 1^{mm} in diameter. Some of the calicles have a long acuminate outer lip.

Cœnenchyma firm, rough, irregularly and roughly pitted, and rudely echinulate.

On the upper branches the larger radial corallites are divaricate, tubular, obliquely truncate, with the calicles opening outward, and with a short, thick, rounded outer lip.

Red Sea ? (coll. Ward), probably now in the Field Columbian Museum. Fragments are in the Yale Museum. No. 6139.

EXPLANATION OF PLATES XXXVI-XXXVI F.

Plate XXXVI.

[All the figures on this plate are natural size.]

Figure 1.—*Acropora tubigera* Horn. Branchlet from the original type. P. 239. No. 1483.

Figure 2.—The same. Upright branch from a Singapore specimen. No. 1370.

Figures 2*a*, 2*b*.—The same specimen. Proliferous tubular corallites and branchlets from the outer and lower sides.

Figures 3, 3*a*.—*Acropora protixa* Ver. Branchlets from the type. No. 1686. P. 237.

Figures 4, 4*a*.—*Acropora striata* Ver. Branchlets from the type. No. 1688. P. 251.

Figure 5.—*Acropora pumila* Ver. Branchlet from the type. No. 1687. P. 250.

Figure 6.—*Acropora turbinata* (Dana). Proliferous upright branch from the type. No. 2017. P. 242.

Figure 7.—*Acropora cytherella* Ver., sp. nov. An upright branchlet from the type. No. 2007. P. 253.

Figure 8.—*Acropora symmetrica* (Br.). An upright branchlet from a Zanzibar specimen. No. 79. P. 254.

Figure 9.—*Acropora dissimilis* Ver., sp. nov. A terminal branchlet from the type. No. 4341. P. 226.

Figure 10.—*Acropora austera* (Dana). A terminal branchlet from the type. No. 4190. P. 226.

Figures 11, 11*a*, 11*b*.—*Acropora tumida* Ver. Branchlets from the type. No. 886. P. 241.

Figure 12.—*Acropora digitifera* (Dana). A terminal branch from the type. No. 430. P. 228.

Figure 13.—*Acropora Wardii* Ver., sp. nov. An upright branchlet from the type. No. 6151. P. 248.

Figure 14.—*Acropora secale* (Stud.). Distal part of an upright branchlet of the type. Ceylon. No. 3063. P. 244.

Figures 15, 15*a*.—*Acropora secaloides* Ver., sp. nov. Distal and middle portions of two upright branchlets of the type. No. 2033. P. 245.

Figures 16, 16*a*.—*Acropora effusa* (Dana). Two upright branchlets from the type. No. 3063. P. 229.

Figure 17.—*Acropora acervata* (Dana). An upright branchlet from the type. No. 4185. P. 220.

Figure 18.—*Acropora fraterna* Ver., sp. nov. Distal part of an upright branchlet from the type. No. 2032. P. 247.

Figure 19.—*Acropora indurata* Ver., sp. nov. Branch from the type. No. 6155. P. 230.

Figure 20.—*Acropora pachycyathus* Ver., sp. nov. Branches from the type. No. 6141. P. 236.

Figure 21.—*Acropora neglecta* Ver., sp. nov. A terminal branch of the type. No. 6126. P. 250.

Figure 22.—*Acropora appressa* (Ehr., Dana). Branchlet. $\frac{1}{1}$. P. 222.

PLATE XXXVI A.

[All the figures on this plate are enlarged about two diameters.]

Figure 1.—*Acropora tubigera* (Horn). A branchlet from an outer upright branch of the type. No. 1483. P. 239.

Figure 2.—The same. Distal part of an upright branch from a Singapore specimen. No. 1370. × 2.

Figures 2*a*, 2*b*.—The same specimen. Proliferous branchlets from the lower side of a lateral branch. × 2.

Figures 3, 3*a*.—*Acropora prolixa* Ver. Branches from the type. No. 1686. × 2. P. 237.

Figures 4, 4*a*.—*Acropora striata* Ver. Branches from the type. No. 1688. × 2. P. 251.

Figure 5.—*Acropora pumila* Ver. A branchlet from the type. No. 1687. × 2. P. 250.

Figure 6.—*Acropora turbinata* (Dana). A proliferous upright branch from the type. No. 2017. × 2. P. 242.

Figure 7.—*Acropora cytherella* Ver. A proliferous upright branch from the type. No. 2007. × 2. P. 253.

Figure 8.—*Acropora symmetrica* (Brook). An upright branch from No. 79. × 2. P. 254.

Figure 9.—*Acropora dissimilis* Ver. (=*M. echidnæa* D.) A terminal branch of the type. No. 4341. × 2. P. 226.

PLATE XXXVI B.

[All the figures on this plate are enlarged about two diameters.]

Figure 1.—*Acropora austera* (Dana). A terminal branchlet from the type. No. 4190. P. 226.

Figures 2, 2*a*, 2*b*.—*Acropora tumida* Ver. Portions of the type. No. 886. × 2. P. 241.

Figure 3.—*Acropora digitifera* (Dana). A branch from the type. No. 430. × 2. P. 228.

Figure 4.—*Acropora Wardii* Ver. An upright branchlet from the type. No. 6151. ×2. P. 248.

Figure 5.—*Acropora secale* Stud. The distal part of upright branches from the type of Dana. No. 3063. ×2. P. 244.

Figures 6, 6*a*.—*Acropora secaloides* Ver. Distal and middle portions of two upright branches of the type. No. 2033. ×2. P. 245.

Figures 7, 7*a*.—*Acropora effusa* (Dana). Two upright branches of the type. No. 3063. ×2. P. 229.

Figure 8.—*Acropora acervata* Dana. An upright branch of the type. No. 4185. ×2. P. 220.

Figure 9.—*Acropora fraterna* Ver. Distal part of an upright branch of the type. No. 2032. ×2. P. 247.

Figure 10.—*Acropora appressa* (Dana). Branchlet. ×2. P. 222.

PLATE XXXVI C.

[All figures on this plate are enlarged about two diameters.]

Figure 1.—*Acropora microphthalma* Ver. A small branch from the type. No. 774. ×2. P. 232.

Figure 2.—*Acropora diffusa* Ver. Portion of one of the types. No. 1808. ×2. P. 228.

Figure 3.—*Acropora stellulata* Ver., sp. nov. Part of a branch of the type. No. 435. ×2. P. 238.

Figure 4.—*Acropora Luzonica* Ver., sp. nov. Portion of a branch of the type. No. 1809. ×1$\frac{4}{5}$. P. 231.

Figure 5.—*Acropora pachycyathus* Ver., sp. nov. A branch of the type. No. 6141. ×1$\frac{5}{6}$. P. 236.

Figure 6.—*Acropora indurata* Ver., sp. nov. A branch of the type. No. 6155. ×1$\frac{5}{6}$. P. 230.

PLATE XXXVI D.

[All the figures on this plate are natural size, except 1*a*, 2*a*, 9, 10, 10*a*, 11.]

Figure 1.—*Millepora nitida* Ver. Part of one of the types. No. 1458. $\frac{1}{1}$. P. 197.

Figure 1*a*.—The same specimen. Surface. ×5.

Figure 2.—*Millepora Braziliensis* Ver. Part of a branch of one of the types. No. 1461. $\frac{1}{1}$. P. 197.

Figure 2*a*.—The same specimen. Portion of the surface. ×5.

Figure 3.—*Acropora urceolifera* Ver., sp. nov. Branch of the type. No. 4187. $\frac{1}{1}$. P. 251.

Figure 4.—*Acropora appressa* Ehr. Branches from Dana's type. No. 2029. $\frac{1}{1}$. P. 220.

Figure 5.—*Acropora acuminata* Ver. Part of one of the types. No. 1007. $\frac{1}{1}$. P. 260.

Figure 6.—*Acropora Ehrenbergii*, var. *scandens?* Klz. Branch from No. 6139. $\frac{1}{1}$. P. 261.

Figure 7.—*Acropora paniculata* Ver., sp. nov. One of the outer branches of the type. No. 3810. $\frac{1}{1}$. P. 259.

Figure 8.—*Acropora cucultata* Ver., sp. nov. Two curved upright branches from near the margin of the type, 8*a*. A marginal branch from the under side. No. 6130. $\frac{1}{1}$. P. 258.

Figure 9.—*Acropora pumila* Ver. A branchlet from the type. No. 1687. ×$2\frac{1}{2}$. P. 250.

Figures 10, 10*a*.—*Acropora paniculata* Ver., sp. nov. Portions of branchlets from the type. No. 3810. ×$2\frac{7}{8}$. P. 259.

Figure 11.—*Acropora effusa* (Dana). Part of a branchlet of the type. No. 3063. ×$2\frac{2}{5}$. P. 229.

Plate XXXVI E.

Figure 1.—*Acropora cucullata* Ver., sp. nov. Two ascending branchlets of upper side of type. No. 6130. ×2. P. 258.

Figure 2.—*Acropora acuminata* Ver. Part of a branch of type. No. 1007. ×2. P. 260.

Figure 3.—*Acropora Ehrenbergii*, var. *scandens ?* (Klz.). Branch of No. 6139. ×$1\frac{4}{5}$. P. 261.

Figure 4.—*Acropora appressa* (Ehr.). Branches of Dana's type. No. 2029. ×$1\frac{2}{3}$. P. 222.

Figure 5.—*Acropora paniculata* Ver., sp. nov. Terminal branchlet of the type. No. 3810. ×$1\frac{9}{10}$. P. 259.

Figure 6.—*Acropora urceolifera* Ver., sp. nov. Branch of the type. No. 4187. ×$1\frac{5}{6}$. P. 251.

Figure 7.—*Acropora neglecta* Ver., sp. nov. Distal part of branch of the type. No. 6126. ×$1\frac{5}{6}$. P. 250.

Plate XXXVI F.

Figure 1.—*Acropora cytherella* Ver., sp. nov. Branchlets of type. No. 2007. ×$2\frac{2}{5}$. P. 253.

Figure 2.—*Acropora turbinata* (Dana). Branchlets of the type. No. 2017. ×$2\frac{2}{5}$. P. 242.

Figure 3.—*Acropora tumida* Ver. Branchlet of type. No. 886. ×$2\frac{2}{5}$. P. 241.

Figure 4.—*Acropora Wardii* Ver., sp. nov. Part of tip of upright superior branchlet of type. No. 6151. ×$2\frac{2}{5}$. P. 248.

Figure 5.—*Acropora neglecta* Ver., sp. nov. Part of branch of type with small lateral branchlet. No. 6126. ×$2\frac{3}{4}$. P. 250.

Figure 6.—*Acropora pachycyathus* Ver., sp. nov. Portion of type. No. 6141. ×$2\frac{3}{4}$. P. 236.

Figure 7.—*Acropora striata* Ver. Part of a branch of the type. No. 1686. ×$2\frac{2}{5}$. P. 251.

Figure 8.—*Acropora tubigera* (Horn). Branchlets of a typical specimen. No. 1370. ×$2\frac{2}{5}$. P. 239.

Figure 9.—*Acropora Luzonica* Ver., sp. nov. Portion of a branch of the type. No. 1809. ×$2\frac{2}{3}$. P. 231.

Figure 10.—*Acropora stellulata* Ver., sp. nov. Portion of a branch of the type. No. 435. ×3. P. 238.

Figure 11.—*Acropora acuminata* Ver. Portion of a branch of a cotype. No. 1007. ×3. P. 260.

Figure 12.—*Acropora indurata* Ver., sp. nov. Small branchlet of the type. No. 6155. ×2¾. P. 230.

Figure 13.—*Acropora urceolifera* Ver., sp. nov. Tip of branch of the type· No. 4187. ×2¾. P. 251.

Figure 14.—*Acropora prolixa* Ver. Branchlet of the type. No. 1686. ×2⅖. P. 237.

Figure 15.—*Acropora microphthalma* Ver. Branch of the type. No. 774. ×3. P. 232.

Figure 16.—*Acropora diffusa* Ver. Portion of a branch of a cotype. No. 1808. ×3. P. 228.

ADDENDA.

Acropora effusa (Dana), see p. 229, and *A. secale* (Stud.), see p. 244.

Under these species I mentioned that they are closely allied, as shown by the types.

A later comparison of the types, with reference to their relationship, shows that, judging from these two specimens, they cannot properly be united, although they agree in mode of growth and some other characters.

The corallites show very evident differences without transitional forms. The axial corallites of *secale* are distinctly larger, throughout, than in *effusa*, and have thicker walls. The radial corallites are larger, more unequal, and more prominent; the larger ones are more tubular, with thicker walls, and a more nearly terminal calicle. In *effusa* they are more obliquely truncated with a shorter inner lip and more oblique calicle.

Of course, a large series might serve to fill the gap between them, but for the present they seem as distinct as most of the related species. The types are both from Point Pedro, Ceylon.

ERRATA.

Page 184, line 6 from bottom, for *Millipora* read *Millepora*.

Page 222, line 19, add PL. XXXVI. FIG. 22 ; and PL. XXXVI B. FIG. 10.

Page 229, line 17, add PL. XXXVI D. FIG. 11.

Page 244, line 8, omit FIG. 5*a* and 14*a*.